ANNUAL REPORT

OF THE

Association of Ontario Land Surveyors

ORGANIZED 1886 INCORPORATED 1892

AND

PROCEEDINGS

OF THE

Fifteenth Annual Meeting since Incorporation

AT

TORONTO

FEBRUARY 26th, 27th, and 28th, 1907.

NO. 22.

ANNUAL REPORT

OF THE

Association of Ontario Land Surveyors

ORGANIZED 1886 INCORPORATED 1892.

AND

PROCEEDINGS

AT THE

Fifteenth Annual Meeting since Incorporation

HELD AT

TORONTO

FEBRUARY 26th, 27th, and 28th, 1907.

Printed for the Association by
THE STEVENSON PRINTING COMPANY
184 ADELAIDE STREET WEST
TORONTO

[illegible]

[illegible]

NOTICES

[illegible]

[illegible]

PREFACE.

To the Members of the Association of Ontario Land Surveyors.

The Proceedings of the Association at its Fifteenth Annual Meeting are herewith presented.

Respectfully submitted on behalf of the Council,

KILLALY GAMBLE,

Secretary.

CONTENTS

ASSOCIATION OF

ONTARIO LAND SURVEYORS

(INCORPORATED 1892.)

Organized 23rd February, 1886.

OFFICERS FOR 1907-1908.

PRESIDENT.

THOMAS FAWCETT - - - - Niagara Falls.

VICE-PRESIDENT.

A. J. VAN NOSTRAND - - - - Toronto.

CHAIRMAN OF COUNCIL.

G. B. KIRKPATRICK - - - - Toronto.

SECRETARY-TREASURER.

K. GAMBLE - - - - - - Toronto.

MEMBERS OF COUNCIL.

HON. F. COCHRANE, Commissioner Lands, Forests, Mines.

P. S. GIBSON, Willowdale,
C. J. MURPHY, Toronto. } For Term Ending April, 1910.

ALEX. NIVEN, Haliburton.
H. J. BEATTY, Eganville. } For Term Ending April, 1909.

G. B. KIRKPATRICK, Toronto,
J. F. WHITSON, Toronto, } For Term Ending April, 1908.

AUDITORS.

L. V. RORKE - - - - - - Toronto.
W. A. MACLEAN - - - - - - Toronto.

BANKERS.

Imperial Bank of Canada (Yonge St. Branch), Toronto.

BOARD OF EXAMINERS.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

COMMITTEES, 1907-8

[illegible]

[illegible] Chairman [illegible]

[illegible]

[illegible]

[illegible] Chairman [illegible]

[illegible] Chairman [illegible]

[illegible]

[illegible] Chairman [illegible]

[illegible] Chairman [illegible]

[illegible] Chairman [illegible] Treas. [illegible]

[illegible] RESEARCH—[illegible] Chairman [illegible] Stewart. [illegible] Treas. [illegible]

PROGRAMME OF THE

Association of Ontario Land Surveyors

(INCORPORATED)

AT ITS FIFTEENTH ANNUAL MEETING HELD AT TORONTO

FEBRUARY 26th, 27th AND 28th, 1907.

Programme.

Tuesday, 26th February—Morning, 10 o'clock.

AT THE REPOSITORY, PARLIAMENT BUILDINGS.

Meeting of Council of Management.
Meeting of Standing and Special Committees.

Afternoon, 2 o'clock.

President's Address. — Otto J. Klotz
Report of Secretary-Treasurer, with Financial Statement. — Killaly Gamble
Report of Committee on Polar Research. — Willis Chipman, Chairman
PAPER—"Municipal Forest Reserves." — Thos. Southworth
PAPER—"The Surveyor and Earthquakes." — Otto J. Klotz

Evening, 8 o'clock.

Report of Committee on Repository and Biography. — W. A. MacLean, Chairman
Report of Committee on Topographical Survey. — Otto J. Klotz, Chairman
PAPER—"Cobalt." — J. F. Whitson
Report of Committee on Legislation. — G. B. Kirkpatrick, Chairman

Wednesday, 27th February—Morning, 10 o'clock.

AT THE REPOSITORY, PARLIAMENT BUILDINGS.

Report of Committee on Publication. — A. J. Van Nostrand, Chairman
Report of Committee on Land Surveying. — A. Niven, Chairman
Report of Council of Management and Report of Board of Examiners. — G. B. Kirkpatrick, Chairman
PAPER—"Descriptions of Properties." — A. J. Van Nostrand
PAPER—"Re-Survey of Lines." — P. S. Gibson

Afternoon, 2 o'clock.

Report of Committee on Engineering. — E. G. Barrow, Chairman
Report of Committee on Drainage. — Geo. Ross, Chairman
PAPER—"Past, Present and Future of Niagara Falls." — Thos. Fawcett
PAPER—"Measurement of Base Lines." — L. B. Stewart
PAPER—"The Outfit for both Winter and Summer for Government Surveys in Northern Ontario." — A. Niven.

Evening, 8 o'clock.

ANNUAL DINNER, McCONKEY'S RESTAURANT.

Thursday, 28th February—Morning, 10 o'clock.

AT THE REPOSITORY, PARLIAMENT BUILDINGS.

Report of Auditors. L. V. Rorke and W. A. MacLean

Memorial to Minister of Lands, Forests and Mines.

Memorial to Sir Wilfrid Laurier.

Report of Committee on Exploration. A. Niven, Chairman

PAPER—The Determination of a Portion of the Ontario and Quebec Boundary. F. J. Patten

PAPER—Surveyors and the Labor Problem. J. McL. Watson.

Report of Committee on Entertainment. Hillary Gamble, Chairman

Nomination of Officers—President, Vice-President, Secretary-Treasurer, Auditors, and Members of Council.

Unfinished Business.

New Business.

Adjournment.

Minutes of the Fifteenth Annual Meeting

OF THE

Association of Ontario Land Surveyors

HELD AT THE REPOSITORY, PARLIAMENT BUILDINGS,

ON THE 26TH, 27TH AND 28TH FEBRUARY, 1907.

At two o'clock p.m., 26th February, the President, Mr. Otto Klotz, called the meeting to order.

The President—Gentlemen, I extend to you all a hearty greeting. I declare this meeting open for the transaction of business of the 15th Annual Meeting. I see the President's address is the first order of business this afternoon, and so without any further remarks, I will now proceed to read the few words I have to say.

The President—I will now call upon the Secretary-Treasurer to give his report.

Capt. Gamble—I regret to say that many members have been very remiss in paying their fees. There is at present due the Association for fees over $1,300. Some of these fees have been allowed to accumulate by members going out of the Province and neglecting to pay before leaving. We have been obliged to prosecute three or four members of the Association, and in that way we have collected some arrears and I fear it will be necessary to continue this mode of collecting in other cases, unless the members are more prompt in paying.

Mr. Niven moved, seconded by Mr. Kirkpatrick, that the report be received and handed to the auditors, and a vote having been taken, the President declared the motion carried.

The President called on Mr. Willis Chipman to read his report on "Polar Research."

Mr. Chipman—Mr. Chairman, the report I have is probably too lengthy to trouble you with, so I will omit certain parts, and it can be printed in the report.

The President—The Association is favored by having Mr. Chipman as Chairman of this Committee. If I am not mistaken,

he was the one who inaugurated the Committee on Polar Research, and there is no doubt he has done a great deal of work in preparing his report. I am sure we are all very thankful to him for keeping us posted on this subject.

It was moved by Mr. T. Fawcett, seconded by Mr. C. D. Bowman, that the report be received and adopted and printed in the proceedings, which, a vote having been taken, the President declared carried.

The President called upon Mr. Thomas Southworth to read his paper on "Municipal Forest Reserves."

Mr. Southworth—Mr. President and gentlemen, I have tried to make this paper as brief as possible, but as it is a subject of great importance, if I am a little long I hope you will forgive me.

That is all I thought necessary to say on the subject, merely to introduce the subject for your consideration and discussion if you see fit to do so. I thank you, gentlemen. (Applause).

The President—The paper is now before you for discussion, and we will be glad to hear any members who are familiar with the subject. I have listened to the paper with a great deal of pleasure and profit. The subject of Forestry has taken a permanent hold in Canada, but it has not yet reached that state of recognition that it should have. It is gratifying to know, however, that it has received some recognition both in the Local and the Federal Government, and I am sure the work in which Mr. Southworth is engaged will be fruitful of good results. It seems to have been the idea to turn all the wood into dollars and cents, and after that the flood, but I hope this will no longer be the case.

Mr. Kirkpatrick—I would move the reception of Mr. Southworth's paper, and that it be printed in the proceedings. I am afraid there will be a great deal of education required in this case. I think the surveyors ought to go and form a School of Forestry, and that each one should be able in the winter time, when the farmers are not so busy, to call meetings and address them on the subject of timber preservation. I believe it would be a splendid thing for our surveyors, as it would bring them before the public, and it would give the idea that they were not such a grasping set of men, because there is nothing in it as far as the surveyors are concerned personally. It would simply be a process of education throughout the country, and I believe that is the only way that any good will be done. Here the bill has been passed for two years, and no municipality is taking advantage of it, why is that? Well, I venture to say nine-tenths of the municipalities don't know in the first place that such a bill has been passed. Then if they do, they have something else to think of.

Our Municipal Councils have their own business to attend to. They say, "let sleeping dogs lie," and so the bill is not taken advantage of.

Mr. Van Nostrand—I have very much pleasure in seconding the motion.

The President put the motion, which, on a vote having been taken, was declared carried.

The President—The next item I see is a paper by myself, "The Surveyor and Earthquakes." I hope you will not be shocked while I am reading it. It is a subject that is perhaps a little out of the ordinary for a surveyors' meeting, but I will try in a small degree to justify the taking up of your time, and show some connection between surveyors and earthquakes.

It was moved by Mr. Niven, and seconded by Mr. C. A. Jones, that the paper be received and printed in the proceedings, and that a hearty vote of thanks be tendered to Dr. Klotz.

The motion was carried, with prolonged applause.

The President—I thank you very much, and I only hope that the surveyors may not have occasion to readjust their lines on account of any earthquake in this country.

At five o'clock the meeting adjourned, to be resumed at eight o'clock p.m.

EVENING SESSION.

At 8 o'clock p.m. the President called the meeting to order.

The President—As Mr. McLean is not here to give his report on Repository and Biography, I will read a short report on Topographical Survey.

In connection with that, I will read the memorial which has been prepared for presentation to the Hon. Mr. Whitney, which I hope will reach him to-morrow morning.

It would be a good idea to memoralize the Dominion Government too, they would be glad to do whatever they could; at any rate, I do not think they are adverse, and a memorial would strengthen the hands of the Government, and I am sure the work would be energetically undertaken. We have, in a quiet way, started the work, but it hasn't received recognition from the Dominion Government as a whole. We would like to see trigonometric surveys over the whole of Canada; but it will take very many years, of course, when placed on a sound basis, and on a large scale, to carry out this work. I would move the

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] that the president [illegible] government. [illegible] members [illegible] the government [illegible] measure [illegible] Mr. Wheeler [illegible] University [illegible] under the auspices of this association. [illegible] here [illegible] and [illegible] standing [illegible] seen some. He showed us photographs looking [illegible] of the mountains, and gave us [illegible] of what [illegible] Canada. Now that is going one through the Rocky Mountains and it should be done through the settled parts of the Dominion as well. I think this survey should go on and get public recognition and I hope Mr. Whitney will take the same line to-morrow.

Mr. Bowman: I noticed in the report, you stated that the plans we have of Ontario are in some cases fragmentary and based upon inaccurate surveys. That is very largely true. In fact, the Director of Surveys has no plans at all of some Townships. If I were to apply to him for a plan of the Township of North Dumfries he would simply tell me they have no records whatever of that Township and the only plan that I know of was one compiled in 1861 by Tremaine Brothers. That is still the only plan of the County of Waterloo, or at least for some of the Townships in it. The survey of one of the Townships was made under instructions of the Commissioner of Crown Lands, and the other Townships were surveyed by private individuals and the Canada Company, and of the Township of North Dumfries there is no plan whatever. For the Township of Waterloo there is a plan

on file for part of the Township, and for the other part no plan at all. I think we will have to do a little missionary work probably and show the Government how much the country is in need of even the simplest kind of plans, saying nothing of the question of contours. In this map of Waterloo County showing the rivers, suddenly a river will disappear because on the original map it is not shown, and there is nothing to this date that shows a person anything about the physical features of the county. I have constantly railway and other people applying to me for maps and so on, and I have some drawings to make blue prints from, but they are very fragmentary, and I think this all goes to show that a trigonometric survey should be started. If we could get these sheets for the older part of Ontario it would be a good thing. Of course it might not help us land surveyors so much, because instead of employing a surveyor, the people would apply for one of these sheets, and they would be able to locate a railway from these sheets if they showed the contours and so on. It might work detrimentally to the surveyors, but I think there will be enough work left to do. I just say this to show it is not entirely in self-interest we are promoting this matter, and I think we ought to make that plain.

The President called on Mr. J. F. Whitson to read his paper on "Cobalt."

Mr. Whitson—I regret that owing to the amount of work I have had I have not been able to get my facts together at present, but I hope in the course of a few weeks to have it ready, so that the Secretary can embody it in the Report.

Mr. Rorke—I would move that Mr. Whitson's paper, when it is prepared, be received and printed in our proceedings.

Mr. Niven—I second the motion.

The President put the motion, which, on a vote being taken, he declared carried.

The President—I notice there is a movement in Ottawa among the Dominion Land Surveyors to re-establish our old Dominion Land Surveyors' Association. I don't know how far it has advanced, but I understand they are having their preliminary meeting very shortly.

The President called on the Secretary to read the paper by Mr. J. M. Watson, entitled "Surveyors and the Labor Problem."

The President—I think we should feel very grateful to Mr. Kirkpatrick. He has offered, when the matter is referred to him, to do all he can. A committee should be appointed to draft a memorial. The suggestion is a good one, that the memorial should

pay a fair wage for the work that is done. Some of the best qualified men are refusing to take day work from the Government, and are doing the simpler work of subdividing the Townships. We are professional men, and should expect to get paid adequately for the services performed. We should refuse to take contract work altogether, and give our services to our native land at a fair wage, and let the Government run the chances. If the men won't work for $45 a month, and we have to pay $60, why shouldn't the Government pay the money? If the supply of labor is short, the Government certainly should be able to pay an increased wage.

Mr. Whitson—I would like to suggest some additional names for drafting the memorial, viz., Mr. Robertson, Mr. Beatty, Mr. Rorke and Mr. J. J. Newman.

The President put the motion, that Mr. Niven, Mr. Fitzgerald, Mr. Van Nostrand, Mr. Fawcett, Mr. C. D. Bowman, Mr. Robertson, Mr. H. J. Beatty, Mr. Rorke and Mr. J. J. Newman be a committee for the purpose of drafting a memorial to be presented to the Minister of Lands, Forests and Mines.

On a vote having been taken, the motion was declared carried.

At 10 o'clock p.m., the meeting adjourned.

MORNING SESSION, WEDNESDAY, 27TH FEBRUARY, 1907.

The President, Mr. Otto J. Klotz, called the meeting to order at 10.30.

The report of the Committee on Publication was then called for.

Mr. Van Nostrand—I must apologize because the report is not ready. The annual report was published this year in a very slow manner, due to a variety of causes, which I hope will not occur another year. We made a very good start, but the mainspring of the Association was called away and remained out of the country for some time, and the other springs did not work well in his absence. Then, as the season drifted on, the printers got unusually busy and could not attend to our work. For those reasons the Report was later in coming out than ever before; but though we made a record in lateness, we think it is rather a creditable production, and owing to its increased volume, it has been an expensive one, still we think, so far as we can judge, that good value has been received. We have had separate copies printed of a number of the articles and items in the report, which can be had from the Secretary separately. My written report I hope to have a little later in the day. I move that it be taken as read. Seconded by Mr. Bolton and carried.

Mr. Van Nostrand [illegible] Department of Property [illegible]

The Chairman—[illegible] interesting paper [illegible] before him and read [illegible] one thinks that [illegible] for discussion [illegible] the Liberty of [illegible]

Mr. N[illegible] and printed [illegible] As the Pro[illegible] us we can [illegible] to [illegible] before us in the Report [illegible]

The [illegible] called for.

The [illegible] report, and, [illegible] question: "How are [illegible] the east and west [illegible]

Mr. Niven—I [illegible] the report. Mr. Blake seconded, and the motion was carried.

The report of the [illegible] the report of the Board of Examiners [illegible]

Mr. Kirkpatrick—[illegible] wish to refer to a memorial to the Premier [illegible] of surveys. The Secretary informed me that Mr. Whitney has his hands full and thought a memorial would be better than an interview, and that if a memorial is sent up he would do what he can in the matter.

The Chairman—I suppose we will have to act on that. We were in hopes that we would be able to interview Mr. Whitney, but of course he is a very busy man. I regret we have not had the pleasure of meeting him personally and presenting this. However, we can only do what he suggests to us and transmit the memorial to him. With your permission, I will read the memorial.

The meeting approved the memorial and it was duly signed.

Mr. Kirkpatrick—I move the adoption of the report. Seconded by Mr. Niven, and carried.

Mr. Kirkpatrick then read the report of the Committee on Legislation, and moved its adoption. Mr. Ross seconded. Carried.

The meeting adjourned at 2 p.m.

AFTERNOON SESSION, FEBRUARY 27TH, 1907.

At 2 o'clock p.m. the President called the meeting to order.

The President called for the report of the Committee on Engineering.

Mr. Barrow not being present, the report of the Council of Management was read by Mr. Kirkpatrick.

It was moved by Mr. Kirkpatrick and seconded by Mr. Gibson that the report be adopted. On a vote having been taken the motion was declared carried.

The President called upon Mr. P. S. Gibson to read his paper on "Re-survey of Lines."

Mr. Ross—I have much pleasure in moving the adoption of Mr. Gibson's remarks, and that they be received and printed in the proceedings.

Mr. Niven—I second the motion.

The President put the motion, which, on a vote having been taken, was declared carried.

The President called on Mr. George Ross to read the report of the Committee on Drainage.

The President—Mr. Ross has taken a great deal of trouble in preparing this report, and we are very much indebted to him.

Mr. Gibson—The trouble is, when you make these inspections you don't know whether you will get your pay or not. As far as the Drainage Act and Watercourse Act is concerned, the last case I had was an individual applying for a drain for a pond hole on his farm. I found he had a drain built on his own land, and he wanted me to make a report that this pond hole should be drained to the public road and down a culvert, or else to the concession line into a creek. I showed him the proper outlet was through his own land and down to a swale. I don't know what the result was. I have had a case where the Grand Trunk came in through a big meadow and they didn't want to spend any money. I said to the engineer or the manager, "This is a very awkward thing that you have done here to stop this improvement. You have blocked the water up in two localities, and these people want an outlet." Well, they said the law didn't compel them to give one. Now, I said, if we took the trouble to inform Mr. Aylesworth, he would make it hot for them. It happened to be in his constituency. I said it wouldn't be profitable for them to be hauled over the coals for a petty expenditure of $100. Well, he said they were ready to do what was right. You cannot force these railways to do anything.

but I hope they will do it. I liked the report: he has acquired a great deal of information, and likely it will keep him out of trouble. I have much pleasure in moving the adoption of the report.

Mr. Newman—I have much pleasure in seconding the motion. I happen to know something about the Southern Limits case, as that happened to go through our office. The Southern Limits Company carried it right through to the Supreme Court, and every court went against them until it reached the Supreme Court of Canada, and the decision of all the lower courts were reversed. Afterwards I understand there was special legislation passed confirming the assessment on this land, and the assessments were collected later. There are a considerable number of what might be considered defects in the Drainage Act, as well as the Watercourse Act, some of which I have been unable to solve. I don't know whether Mr. Ross has been able to solve them all or not. You get into deep water once in a while, but I think Mr. Ross's paper covered the ground pretty well. There is one question I would like to ask, and that is, if he has ever made an inspection under the Ditches and Watercourses Act, an amendment which requires the engineer to inspect after the time allotted for completion, and if he found the drain completed according to terms, from whom did he collect his fees?

Mr. Ross—I always put in my award a statement of what I suppose the cost of the inspection will be. I say my fees will be so much, the Town Clerk's fees are so much, and the cost of inspection so much, and then the money is there to be paid over when you inspect. Some engineers draw the money, and if their fees do not amount to as much as they expected, they return the balance to the Council, to be returned to the man from which it was collected. I think the proper way is to put the fees in the award in the first place. You may inspect it for a little more or a little less, but always put down enough.

Mr. Gibson—Supposing the Council refuses to pay it?

Mr. Ross—The Council wouldn't refuse. The Clerk generally takes an interest in it, and you are notified when the work is done.

Mr. Gibson—I have had a little experience along that line, and most certainly I put my fees in my bill, and I draw it too. Then I go and inspect the work when it is finished. When I go to a place, I say they must pay me my fees for coming up here, and they say they will pay me before I leave, and that settles the matter. Now, with reference to inspection, I think there is a limit. It doesn't say immediately on completion, but I think there is a limit. I think in a year, if it can be shown the work had not been done, you are justified in not going. There has been a case

decided on that point in which it was two years before the engineer inspected.

The President put the motion, which, on a vote having been taken, was declared carried.

The President called on Mr. Thos. Fawcett to read his paper on "The Past, Present and Future of Niagara Falls."

Mr. Fawcett—I have not attempted to write a technical paper on this question, nor yet a scientific paper, but just a story of Niagara.

The President—Although, as Mr. Fawcett says, it is not a technical paper, I venture to say it will be read with a great deal of pleasure by the members of the Association.

Mr. Niven moved, seconded by Mr. Selby, that the paper be received and printed in the proceedings.

The President put the motion, which, on a vote having been taken was declared carried.

The President called on Prof. L. B. Stewart to read his paper, on "Measurement of Base Lines."

Prof. Stewart—Mr. Chairman and gentlemen, I have been so extremely busy I have had very little time to spend in the preparation of a paper, so that the paper is more in the nature of an abstract than a finished paper.

Mr. Fawcett—I move that Professor Stewart's paper be received and published in the proceedings.

Mr. J. G. Dalton—I second the motion.

The President put the motion, which, on a vote having been taken, was declared carried.

The President called on Mr. Niven to read his paper on "The Outfit for both Winter and Summer for Government Surveys in Northern Ontario."

It was moved by Mr. Van Nostrand, and seconded by Mr. Bolton, that the paper be received and printed in the proceedings.

The President put the motion, which, on a vote having been taken, was declared carried.

5 o'clock, Convention adjourned.

MORNING SESSION, THURSDAY, FEBRUARY 28TH, 1907.

At 10.30 o'clock a.m. the President called the meeting to order.

The President called on Mr. L. V. Rorke to read the report of the Auditors.

Mr. Rorke moved the adoption of the report, which was seconded by Mr. Ross.

The President put the motion, which on a vote being taken, was declared carried.

The President called on Mr. Niven to read the report on Exploration.

Mr. Niven moved the adoption of the report, which was seconded by Mr. T. J. Patten.

The President put the motion, which on a vote being taken, was declared carried.

The President called on Mr. T. J. Patten to read his paper on "The Determination of a Portion of the Ontario and Quebec Boundary."

It was moved by Mr. Rorke, and seconded by Mr. Fawcett, that the report be received and printed in the proceedings.

The President put the motion, which, on a vote being taken, was declared carried.

The President called on Mr. E. G. Barrow to read the report of the Committee on Engineering.

It was moved by Mr. Barrow, and seconded by Mr. Patten, that the report be adopted and printed in the proceedings.

The President put the motion, which, on a vote being taken, was declared carried.

The President called for the report of the Entertainment Committee, which was agreed to be taken as read.

The meeting then adjourned for ten minutes, for the purpose of discussing the nominations.

The President—The next order of business is the election of officers, and just here I would like to say that I appreciate very much the honor you did me in appointing me President of this Association. I feel that I have not worthily represented you, but it is practically impossible for me to be at your meetings. I am very glad that I was able to get away and be here with you this time, and I thank you again very much.

Mr. Fawcett—I would like to name Dr. Klotz for a second term.

Mr. Van Nostrand—I second that.

Dr. Klotz—I appreciate your intention very much, but it is utterly impossible for me to accept the position, and I am sure the Vice-President will occupy it well.

Mr. Niven—I have much pleasure in nominating Mr. Fawcett as President for the coming year.

There being no other nominations, the President declared Mr. Fawcett elected as President of the Association. (Applause.)

Mr. Fawcett—This is an honor which I hardly feel myself worthy of, as it requires a man of ability like the retiring President to do justice to the position; but since you have elected me I shall do the best I can. I thank you. (Applause.)

Dr. Klotz—There is a member in the Association who has perhaps given more time for the benefit of the Association and for the benefit of the members than any other member, and it is one of the little rewards that is in the hands of the members, by which they express their appreciation to elect such a member to one of the offices of the Association. If you will allow me, I will nominate Mr. Van Nostrand as Vice-President for the coming year.

There being no other nominations, the President declared Mr. Van Nostrand elected Vice-President for the coming year. (Applause.)

Mr. Van Nostrand—I thank you, sir, for the honor you have done me. I thank the gentlemen here present for the support they have given to the motion. I have tried to do my best in helping along the affairs of the Association, and I hope my inefficiencies and deficiencies have not been as apparent to others as to me. Whatever I can do in the future for the advancement of the Association I will gladly do.

The President called for nominations for Secretary-Treasurer and expressed the hope that the present officer would be continued in office if he would consent to act.

Mr. Niven—I have much pleasure in moving the nomination of Capt. Gamble for the office of Secretary-Treasurer. (Applause.)

Captain Gamble—I thank you, gentlemen, for the honor you have done me in again making me the Secretary of this Association. I have the interests of the Association at heart, but I feel I am very often not competent to discharge the duties as well as many others might do. Last year I was obliged to go to the Old Country, but my place was more than well filled by Mr. Van Nostrand in my absence. I will endeavor to do all in my power during the ensuing year to carry out the wishes of the Association. (Applause.)

The President called for nominations for auditors.

Mr. Kirkpatrick—I nominate the two present auditors for re-election, Mr. Rorke and Mr. MacLean.

There being no other nominations, the President declared Mr. Rorke and Mr. MacLean elected as auditors for the coming year.

The President—The next nomination is for the two members of the Council who will take the places of the two retiring members. The members who retire this year are Mr. Gibson and Mr. Gaviller.

Mr. Kirkpatrick—I nominate Mr. P. S. Gibson.

Mr. Fawcett—I nominate Mr. Fitzgerald.

Mr. Rorke—I nominate Mr. Gaviller.

Mr. Van Nostrand—I nominate Mr. C. B. Bowman.

Mr. Whitson—I nominate Mr. Hutcheon.

Mr. Bolton—I nominate Mr. C. J. Murphy.

Dr. Klotz—I nominate Mr. H. J. Beatty.

Mr. Whitson—I nominate Mr. W. J. Blair.

The President—The next order of business is unfinished business. I have in my hand several motions which I will present to the meeting.

The first one is a motion by Mr. Rorke, seconded by Mr. Fawcett, that the sum of $275 be paid to the Secretary-Treasurer for the past year. Carried.

The next one is moved by Mr. Fawcett, seconded by Mr. Bolton, that the sum of $5 be handed to each of the auditors of the Association for their services during the past year. Carried.

The next one is moved by Captain Gamble, seconded by Mr. Van Nostrand, that any errors or omissions in the report of the proceedings now in the hands of the Secretary and the stenographer, be corrected by them before being printed in the Report. Carried.

Mr. Rorke—I think the Committee appointed to present the memorial were to read it to this meeting. I have reference to the one to the Minister of Lands, Forests and Mines.

Mr. Niven read the memorial to the Minister of Lands, Forests and Mines.

The President—I think from the statistics which have been given by some of the members of the Association, that the figures in the memorial to the Government are very reasonable indeed, and only what is just and fair towards the surveyor.

Mr. Fawcett—I move the adoption of the report of this Committee.

Mr. Fitzgerald—I second it. Carried.

Mr. Kirkpatrick—I move that a vote of condolence be taken and a letter be sent to the members of the families of the deceased members of the Association. There were four mentioned, I think.

The President—I think this is the least that the Association can do to express their feelings at the loss of the members by death, and the Secretary will prepare a note to be sent to the respective families.

The chair was then vacated by Dr. Klotz, and taken by Mr. Fawcett.

Mr. Kirkpatrick—I don't think this meeting should close without our expressing our deep sense of obligation to our late President for his untiring services and for his wonderful skill in conducting this meeting. You are all conscious how he has carried on the business at this session, and I am sure every one present is grateful to Dr. Klotz for coming here as our President. We know he is a very busy man, yet he has taken the time to preside at our Annual Meeting. I don't like to butter up a man before his face, but I feel we owe a deep obligation to Dr. Klotz, and I therefore move that a hearty vote of thanks be given to him.

Mr. Niven—I have much pleasure in seconding that motion. I entirely concur with the remarks made by Mr. Kirkpatrick. I would like to add more to it, but I cannot express my feelings as Mr. Kirkpatrick has done.

The motion was put by the new President, and carried unanimously with prolonged applause and the singing of "For He's a Jolly Good Fellow."

Dr. Klotz—Mr. President and Gentlemen: This is certainly a very happy ending to my year of office. As I have said before, I feel I have not done quite what is expected or required of a President, as this is my only appearance during the year of my holding office. However, I have tried during the three days I have been here to fill the chair to the best of my ability. I have contributed a paper to the Association, and I hope in the future to assist in any way I can, and occasionally to contribute papers. I may be accused of writing too much on the technical side, but it may give a little variety to the papers to have something a little outside of the ordinary line, like the "Earthquake and Surveyors." I suppose some of you thought there was no connection between an earthquake and surveyors, but I hope I have made it clear that this is possible. Many questions arise from time to time, and whenever I come across anything of interest to surveyors I will always be ready to give my slight contribution to the Association. I thank you, gentlemen.

I suppose it only remains now for me to close the meeting.

When I look at the members present and the number of members on our list I am sure the surveyors are not doing their duty to the Association to the extent they should. Perhaps if I might make a personal remark I think there are more members even in Toronto who might attend the meetings. In attending at these meetings we help each other. It is something like the value of the Kimberley diamond. As the more the diamond has a value, but after it has been polished and polished its value is increased many times fold, and that is the way with men. If men do not come together and meet each other they get rusty and musty, but when they come to a meeting like this they get polished up. I hope more members will be here at our next meeting. If there is no other business I now declare the Fourteenth Annual Meeting of this Association closed.

Reports.

REPORT OF SECRETARY-TREASURER.

Mr. Chairman, I have the honor to submit my report of the official business of the Association transacted by me between the 26th February, 1906, and the 26th February, 1907.

With the assistance of Mr. A. J. Van Nostrand, the Chairman of the Publication Committee, I reviewed the minutes of our meeting and prepared the papers that had been read before the Association for publication.

The undermentioned Societies exchanged reports with us, and we sent them the subjoined numbers of copies of our report:

School of Practical Science, Engineering Society.....	100 copies.
Michigan Engineering Society	130 copies.
Ohio Society of Surveyors and Civil Engineers.....	100 copies.
Illinois Society of Engineers and Surveyors.....	150 copies.
Indiana Engineers' Society	130 copies.
Iowa Civil Engineers' and Surveyors' Society.....	115 copies.

The Board of Examiners has during the past year admitted to our Association 10 members, and we have lost by death 4.

I regret that during the past year pressure of business seems to have hindered many of our members from communicating to us matters that might have been of interest to the Association.

Our surveyors seem each year to be more in demand, and especially where new lines of railways are being constructed.

Our thanks are due to the various departments through whom we have regularly received the Annual Reports of the United States Coast and Geodetic Survey, the Geological Survey of Canada, the Dominion Archives, and the Ontario reports of the Bureau of Mines and the Bureaus of Industry and Forestry.

The financial statement accompanying this report exhibits a prosperous condition of the Association.

Again I conclude with my warmest thanks to the members of the Association for their continual kindness and for the assistance they have given me in the execution of my duties.

KILLALY GAMBLE,
Secretary-Treasurer.

STATEMENTS OF BALANCES, RECEIPTS AND EXPENDITURES BETWEEN 26TH FEBRUARY, 1906, AND 26TH FEBRUARY, 1907.

Dr.

To Balance in Savings Account 26th February, 1906..	$ 655 70
" Balance in Current Account, 26th February, 1906..	1,777 35
" Receipts in Board of Examiners' Account, including Government grant of $200, and regular fees..	740 00
" Annual fees, including Association fees.....	545 92
" Amount collected from advertisements.....	51 10
" Accrued interest on Savings Account.....	36 90
	$3,806 97

Cr.

By Amount for publishing Proceedings, 1906-7.....	$ 514 30
Amount granted Secretary-Treasurer (1905-6)	275 00
Amount paid for postage	80 24
Amount printing and stationery	41 75
" Stenographers' fees, reporting Annual Meeting (1906-7)	50 00
Amount granted to Auditors	10 00
Freight, express, bank exchange, Customs brokerage and sundries	18 63
" Assurance on Secretary's bond	7 50
" Lantern for lecture	6 50
" Duplicating examination papers.....	17 50
Extra copies of Michigan Engineer	40 00
" Caretaker of Repository.....	10 00
Marking tapes	11 00
F. L. Blake, astronomical tables	65 00
	$1,147 42
Amount of disbursements in Board of Examiners' Account	253 30
Balance in Savings Account	2,192 60
Balance in Current Account	213 65
	$3,806 97

KULALY GAMBLE,
Secretary-Treasurer.

REPORT OF THE COUNCIL OF MANAGEMENT FOR THE YEAR 1906.

The Council begs to report to the Association of Ontario Land Surveyors that it has held two meetings since the last meeting of the Association, one on the 25th of May, 1906, and the other on the 26th February, 1907.

At the meeting of the 25th May, 1906, Mr. George B. Kirkpatrick was appointed Chairman of the Council for the ensuing year.

The Council passed By-law No. 48, to exempt from dues Joseph Doupe, of Winnipeg. The By-law is as follows:

Whereas it has been proven to the satisfaction of the Council that Joseph Doupe, O.L.S., was granted a commission as Provincial Land Surveyor for Ontario on or about the 13th day of January, 1863, and that the said Joseph Doupe has been for many years and is now a non-resident of this Province; it is therefore enacted that the said Joseph Doupe is hereby granted exemption from dues under the authority of sub-section 4 of section 42, chapter 180, Revised Statutes of Ontario, 1897.

At this meeting the several Standing and Special Committees required by the statute, by-laws and resolution of the Council, were appointed. The resolution moved by Mr. G. B. Abrey and seconded by Mr. George Ross at the Annual Meeting of the Association on the 1st of March, 1906, regarding the preparation of an astronomical table, was discussed, and under the authority thereby given the Secretary was instructed to have required tables prepared by Mr. Frank L. Blake, at a cost of $65, such tables to cover from 42 degrees to 52 degrees north latitude.

The Council has to regret the loss of five members of the Association by death since the last meeting, namely, Samuel Howells Bigger, who died in British Columbia; William Spry, who died in Toronto; Royal Wilkinson Hermon, who died at his home in Rednorsville on the 9th of February of the present year, and W. T. McGeorge, of Chatham, and George B. Abrey, of Toronto Junction.

Respectfully submitted,

GEORGE B. KIRKPATRICK,
Chairman of Council.

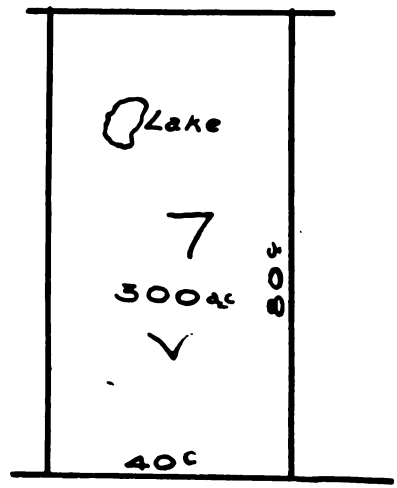
Toronto, February 27th, 1907.

REPORT OF COMMITTEE ON LAND SURVEYING.

Mr. President.—Your Committee on Land Surveying for the Association year of 1906-7 beg leave to report that general dissatisfaction exists among those surveyors employed on Government work as to prices paid, and it is hoped that some steps may be taken that will result in a more equitable arrangement than that of 1906.

Only one question has been submitted to the Committee through the Question Drawer.

A. NIVEN,
Chairman.



(a) How and where would you run the line between the east and west halves of Lot 7?

Modern system—6 mile township. Lake shown correctly in original returns.

(b) If lake not shown in original returns and area not deducted does it affect the patent?

QUESTION DRAWER.

"HOW AND WHERE WOULD YOU RUN THE LINE BETWEEN THE EAST AND WEST HALVES OF LOT 7?"

Mr. Kirkpatrick spoke on this question, illustrating his remarks by reference to a sketch on the blackboard. He said: A similar question to that was a puzzler to the students. It seems as easy as possible to do it, that there can be no two ways of doing it, yet I think there were half a dozen ways discovered, five of them being wrong.

Mr. Gibson—What is the practice of the Department?

Mr. Kirkpatrick—To follow out the Survey Act. I will show exactly the picture which was presented to the eyes of the students. As I told the students, if they got an orange and divided it into two equal parts, would there be more in one-half than in the other? They said, "No." Then I said, "Why do you divide the lot differently?" The simple way to do it is, if the front of the lot is 40c and the east and west boundaries are 80c and 79c, there are 318 acres in the lot. You divide 318 by 2 and get 159 acres for each part. You then calculate what the frontage would be that would give exactly 159 acres in each half, and run the dividing line parallel to the governing line. The lake, as all surveyors know in their instructions, forms no part of the lot, even if a broken lot. We had an argument last night as to the worth of descriptions. A description which is not correct is not worth a dollar. (The Chairman—That is right.) The description which is correct is worth a great deal more. (Hear, hear.) The chief point in our business in Northern Ontario is to make correct descriptions. It is marvellous that there should be half a dozen ways when only one way is correct. The surveyor has got to remember now, when quarter section lots are sold for a million dollars, that people want to know where they are and want to be absolutely sure that there is no doubt they have got the piece of land that their patent shows. Now, if it is a full lot, the simple designation is perfectly right; but then, the designation being perfectly right in the patent, it does not follow that it is right on the ground. If a surveyor is instructed by the patentee, who says: "There is my patent for the north-west corner; I want that laid out," and he runs a line down 40 chains and lays it out in this way, it is not

[illegible] [illegible] the trouble of measuring the [illegible] and [illegible] the true line.

Mr. [illegible]: [illegible] that those lots have to be re-measured from the [illegible] as it stands on the ground when the surveyors go [illegible] and that we are not to take the chain measurement on the [illegible].

Mr. Kirkpatrick: Yes, what is the good of it.

The Chairman: If there is a lake in the lot it appears to me that [illegible] upon our climate or the state of our rainfall how large the lot is. In, notice, the south or north half has a [illegible] no matter how many lakes there are. If I understand Mr. Kirkpatrick, this boundary must be shifted. That is a very [illegible] to me. Supposing the grant were made and supposing we knew this lake is there. For years hence that lake might be dry, and the [illegible] of the lot might be shifted by the condition of the water [illegible] or not that is actually. The sub-division of a lot is a [illegible] thing. When the Government would grant title to the amount of land they would not grant the water. They would say: "We were going to sell you 80 acres but because there is water there we will only sell you, or convey to you, 60 acres."

Mr. Kirkpatrick: What the Department understands by a lot is a full lot. It understands by the term broken lot all lots broken by water. The land under the water forms no part of that lot. The area of a broken lot is the area of land in it. Now then, the Department could sell, after they granted the whole of that broken lot, [illegible] to another person who discovered mineral under that lake. They would not ask the man who owned the broken lot whether he [illegible] or not. We know that was done in the case of [illegible] Lake the other day. Another thing a surveyor has to remember is that when a man stakes out a portion of a lot he has to stake out the land in that portion. If he wants the land under the water that is conveyed in a separate grant, that does not form any part of the lot. He stakes out a broken lot, and then has to make another claim if he would absolutely enjoy what lies under water. Of course I am not talking about lakes which were not seen or not known. There is no question about it that if a lot was granted as containing 320 acres, and there was a lake which the surveyor never saw and the Department was unaware of, the patent would carry that lake. Probably the party who owned the lot would come down afterwards and say, "There is a big lake, and I want to be relieved from it." Well, if he got a surveyor to survey it any time within five years, a supplementary patent, if it was in the northern country, would be granted, deducting the area of water and refunding the money. You could not lay out an aliquot part of a lot. With a lake in it, you must lay out the portion by metes and bounds.

Mr. Fawcett—It is better to avoid aliquot parts where there is a broken lot.

Mr. Kirkpatrick—Yes, that is a regular rule; describe it by metes and bounds as part of a broken lot, but never describe it as an aliquot part. If I knew there was a lake there I would go in and survey it. I would give the man half the land and run the line parallel to the governing boundary.

Mr. Blake—Astronomically, of course.

Mr. Kirkpatrick—Yes. I contend the section line is governed by the section from which the lots are numbered.

Mr. Ross—I do not see why you take no account of the convergence of meridians in the lines dividing east and west halves.

Mr. Kirkpatrick—You cannot run two lines mathematically parallel on a sphere; practically, of course, you can, but theoretically you cannot.

Mr. Gibson—I think most of the surveyors think the lake is part of the lot, and in the Northwest they cheerfully take it up. Here, where the lakes are permanent, if the lake in that lot is 10 acres, we call it part of the lot, but when a purchaser gets the deed from the Crown for a broken lot, the Crown only sells him so many acres of land and excludes the lake from his title. Where is the lake then?

Mr. Blake—It becomes part of the lot if drained.

Mr. Kirkpatrick—We have had an instance of that in Otter Lake. It was reduced to a much smaller area, and the area of land was increased, but the effect of draining that lake did not give the new land to the riparian owners adjoining. They had to come to the Department and take out a patent and pay for it.

Mr. Van Nostrand—Is the lake to be considered, for the purposes of title, as part of the lot? We have had the ruling of the Director of Surveys, that where a lake is shown on the original plan it is not considered any part of the land. Therefore, the title to the lake vests in the Crown. We know what Province it belongs to, but what municipality, what Township, what designation it is to be known by, is a little obscure. It is Crown lands within a certain Province, but I do not know just how it should be designated. It is a lake surrounded by parts of a lot.

The Chairman—And the adjoining country.

Mr. Van Nostrand—Then we have the other question suggested by the President, that the owners of the two halves of that lot will assume that the patent is granted for the full lot. Now suppose of the three hundred acres of dry land at that time one-half was

sold the east half and the owner at the time of the sale had a survey made. Five years later his neighbor also had a survey made by the same surveyor who followed out the principles laid down today. But it was a dry time, and the fences got a jogging worse than they did by the earthquake we heard about yesterday. Now suppose the lake had not been shown on the original plans, but existed just the same and had not been seen by the original surveyor, did the Crown grant the title?

Mr. Kirkpatrick.—Yes, for the lot.

Mr. Van Nostrand.—Then he has no further concern. He has a valuable marl bed or a river vein for nothing, without it being necessary for him to get a new patent on that lake.

Mr. Kirkpatrick.—We do not describe it as being part of that lot, but as being within the limits of the lot.

Mr. Van Nostrand.—Is not a concession composed of a certain number of lots running within its limits?

Mr. Kirkpatrick.—The concession is run on the ground. A [illegible] near Guelph. There was a question, did the Crown equally own the land under the water of the lake?

Mr. Van Nostrand.—Was it settled?

Mr. Niven.—The other part of the question is, "If the lake was not shown in the original returns and the area is not deducted, does it affect the patent?"

The Chairman.—Mr. Kirkpatrick has answered that, I think.

Mr. Niven.—Well, the answer of the Committee is as Mr. Kirkpatrick has stated. The east half of that lot is half of the area made by a line parallel to the east boundary, the governing line.

Mr. Gibson.—Including the lake?

Mr. Niven.—Then supposing the lake was not seen at all, and the surveyor ran round it on the north-east and south, and the whole lot was given as 320 acres, and then afterwards there is a half of it sold, the west half might contain the lake and the man would own it.

Mr. Blake.—I think Mr. Kirkpatrick's ruling was to divide the dry land into halves and quarters. That is a good thing for the surveyor. A man could not do it in a short time. He would really have to find the area, the point of commencement, and adjust it so as to run it parallel to the eastern boundary astronomically north. That is quite a difficult matter to do, and adds to the cost of the survey.

Mr. Ross.—Suppose, Mr. Kirkpatrick, you went out to survey

that lot and found it to contain 320 acres, and then went in and traversed the lake and found it was 15 acres instead of 20, what would happen if the patent was for 300 acres?

Mr. Kirkpatrick—You see, the man has got the whole lot, so you don't want to bother about the lake at all. The area might be more or less than 20 acres.

Mr. Blake—Suppose the lake is dried up?

Mr. Kirkpatrick—Are we talking about Northern Ontario, or the Northwest? I do not know of any lake in Ontario which disappears in the summer and re-appears in the fall. There is no variation about a lake. If a lake is there, it is a lake all the time. There are plenty in the swampy grounds, but I would not call a wee pond a lake. I would shut my eyes and call that part of the lot. We are talking of a lake of from 25 to 30 acres.

Mr. Blake—Permanent water?

Mr. Ross—High water mark would show the edge of vegetation.

Mr. Gibson—What I understand is that the Department considers a lot with a lake as a broken lot. They do not sell portions of it by aliquot portions, but by metes and bounds. Therefore the trouble suggested here is imaginary.

Mr. Van Nostrand—It is so now, but it was not always so.

Mr. Ross—The best way is to deed the portion by metes and bounds. It would save a good deal of surveying.

REPORT OF BOARD OF EXAMINERS OF ONTARIO LAND SURVEYORS, 1906-7.

The Board met at the Board Room, Department of Lands, Forests and Mines, on Monday, the 11th February, 1907.

The following candidates passed the required Preliminary Examination:

William Herbert Brown, Toronto, Ont.
Herbert McEwen Anderson, Dundas, Ont.
Robert Wilmott Code, Alvinston, Ont.
Duncan Grantly Ricketts, Fort William, Ont.
Roger Melville Lee, Hamilton, Ont.

James Thomas Corbett, Arnprior, Ont.
Thomas Charles Douglas Sewell, Toronto, Ont.

The following candidates passed the required Final Examination:

William Engel Holland, Toronto, Ont.
Robert Dennis McCaw, Welland, Ont.
Wallace Smith, Toronto, Ont.
Hanbury Thomas Beatty, Toronto Junction, Ont.
Albert George Stacey, Ottawa, Ont.
Homer Llewellyn Seymour, Ottawa, Ont.
John Morgan Empey, Ottawa, Ont.
Charles Campbell Smith, Ottawa, Ont.

Messrs. Robert D. McCaw, Wallace Smith, and Charles C. Smith were duly sworn in.

Messrs. Beatty, Stacey, Seymour and Empey to present themselves for the purpose of being sworn in at a later date.

The following articles were filed by the undernamed pupils during the year:

Name of Pupil	Name of Surveyor	Residence	Date of Articles	Terms
[illegible]	[illegible]	[illegible]	27th Feb., 1900	5 years
[illegible]	[illegible]	New Liskeard	12th Feb., 1900	5 years
[illegible]	[illegible]	Egansville	20th Feb., 1900	5 years
[illegible]	[illegible]	[illegible]	2nd April, 1900	5 years
[illegible]	[illegible]	[illegible]	6th March, 1900	1 year
[illegible]	[illegible]	Toronto	10th Feb., 1907	5 years

The following bonds have been approved and filed with the Provincial Treasurer in accordance with the Revised Statutes of Ontario, 1897, chapter 181, section 30, sub-section 2:

Michael Edward Brian.
Uriah W. Christie.
James H. Smith.
Charles H. Fullerton.
Thomas H. Dunn.
Edward R. Bingham.
Edward O. Fuss.
Samuel R. Crerar.

Respectfully submitted.

GEO. B. KIRKPATRICK,
Chairman of Board.

REPORT OF COMMITTEE ON LEGISLATION.

The Committee begs to report as follows:

It will be in the memory of the members that at last year's meeting a discussion took place regarding making proposed amendments to the Survey Act, in view of the probable revision of the Statutes by the Legislature, and a Committee was appointed by the Council of Management to undertake this work. Owing, however, to the delay in sending out the report of the proceedings, no action was taken until the 19th December last, when the Chairman sent out a notice to all the members of the Committee on Legislation, referring them to page 26 of the Report of the Association last year, and asking them to submit any alterations or amendments which they thought might be necessary in the Survey Act or in the Acts kindred thereto. Most of the members of the Committee replied that they did not know of any particular amendment calling for instant alteration, and as the Act for the Revision of the Statutes will not be passed until next year, it would be well to reappoint a strong Committee, who may take the matter in hand and suggest such alterations as the Association may think desirable. There is one amendment which it is proposed to ask the Legislature to pass this year. It relates to sections concerning the manner in which municipal surveys are performed, and your Committee thinks that these amendments would be most desirable. The Honorable the Attorney General has been asked to take charge of the amendments to the Surveys Act. The amendments are as follows:

AN ACT TO AMEND THE SURVEYS ACT.

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1. Sub-section 3 of section 14 of the Surveys Act is hereby amended by adding at the end of such sub-section the following words, "and for the purpose of establishing such two nearest points or places, the surveyor who makes the survey may, if necessary, survey farther than the points mentioned in the Council's application."

2. Sub-section 5 of the said section 14 is hereby amended by inserting at the end of such sub-section 5, the words following: "or the Council may, without a previous estimate, levy on the said proprietors in the properties aforesaid the amount of the expense when the same shall have been incurred and ascertained, and the Certificate of the Minister of Lands, Forests and Mines certifying the amount of such expense shall be conclusive."

3. The said section 14 is hereby further amended by adding thereto the following as sub-section 6 thereof:

4. Where an application is made by a Council upon its own motion, such Council may, if it deems the application to be in the public interest, proceeding to determine the boundaries or limits of any public road or highway, or the like, to pay out of the general funds of the Township the whole of the said expense or such portion thereof as the Council may deem proper; and in the event of the Council paying only part of the expense out of the general funds, the Council may order that the remainder of the expense may be borne by the said proprietors in the proportion and manner aforesaid.

All of which is respectfully submitted.

GEO. L. KIRKPATRICK,
Chairman.

REPORT OF COMMITTEE ON TOPOGRAPHICAL SURVEY.

The mills of the gods grind slowly, but the grist is good. Last year the report recorded the beginning in a small and quiet way of the triangulation, starting from Ottawa and proceeding down the Ottawa River. This year it is with pleasure we report that this work, consisting at present of station-building, scaffolding reaching to 70, 80 and even 90 feet in height, is approaching the St. Lawrence, our main waterway, and which deserves, perhaps, our first attention. The work so far undertaken is under the direction of the Chief Astronomer.

It is believed that the work could be furthered if our Association would memorialize the Dominion Government in behalf of the trigonometrical survey of Canada, and that survey is considered a highly necessary national undertaking.

Respectfully submitted.

OTTO KLOTZ,
Chairman.

REPORT OF COMMITTEE ON POLAR RESEARCH.

Mr. President, On March 1st, 1894, a resolution was introduced at the Annual Meeting of the Association, appointing a Special Committee to submit a report upon explorations in Arctic Canada. The instructions given the Committee were, however,

not strictly interpreted, as will be noted from the various reports presented year by year.

In the 1896 proceedings will be found a plan of the circumpolar regions reduced from a large plan on file in the archives of the Association.

Two interesting papers by Mr. J. W. Tyrrell aroused interest in the Association, the first, "Through the Barren Lands," presented in 1896, and the second in February, 1900, entitled "Coast and Harbor Surveys in Hudson's Bay and Strait."

Mention should also be made of the correspondence with the Department of the Interior in December, 1896 and 1897, which will be found in Mr. Tyrrell's report of the Committee in the 1897 proceedings.

The attention of Canadians, particularly those in the vicinity of Toronto, was drawn to the Arctic regions by the Association securing Lieut. R. E. Peary to lecture in Toronto in February, 1896, after his return from explorations in North-eastern Greenland. His achievements were, however, eclipsed by those of Prof. Nansen, who returned from his farthest north in the latter part of 1896.

Mention should also be made of Capt. Bernier's lectures in 1901, in which year a carefully drawn memorandum was presented to the Dominion Government by the Association respecting explorations in the Arctic regions, and the importance of these lands to Canada.

Prof. Nansen's lecture in the November following Peary's lecture, served to stimulate our interest in our most northerly lands, but unfortunately not to a sufficient degree to induce members of this Association to volunteer as apprentices.

Year by year the appeals of the Committee have apparently been in vain, but we believe that the recent activity and interest shown by the Dominion Government has been due to early missionary work performed by this Association.

In our report of last year, we omitted to notice the cruise of the "Neptune," under the command of Mr. A. P. Low, now Director of the Geological Survey of Canada. As this was the first expedition sent to the Arctic regions by Canada, a summary of the narrative, which appeared in book form in 1904, may be of interest.

In the spring of 1903 the Dominion Government decided to send a cruiser to Hudson Bay and the Arctic islands, to establish stations for the collection of customs, the administration of justice, and the enforcement of the law. The "Neptune," a Newfound-

land whaler of 465 tons, was chartered for the expedition, which sailed from Halifax on August 23rd, 1903. After touching at several Labrador ports, the east coast of Baffin's Land was visited, then harbors in Hudson's Strait.

The vessel arrived safely at Fullerton Harbor, Lat. 38 deg., 55 min. in the north-west part of Hudson's Bay, in the latter part of September, and immediately work was commenced on the erection of buildings on shore for housing the crew and the six members of the Northwest Police Force, who accompanied the expedition to this point.

During the time the vessel was frozen in, surveys were made of the shores of the islands and of the mainland for many miles north and south of Fullerton.

In May, 1904, Wager Inlet was explored, and the south-west shore of Southampton Island.

It was not until July 18th that the "Neptune" was able to break her way out of Fullerton Harbor, and she arrived at Port Burwell, at the easterly entrance to Hudson's Strait on July 25th.

Taking on coal and provisions detained the "Neptune" in port until August 2nd, when she started on her northern cruise. On August 6th Disco was passed, and Cape York was reached on August 7th, a remarkably quick passage across Melville Bay.

The winter quarters of Lieut. Peary in 1902-03 at Cape Sabine, and of the unfortunate Greely expedition in 1883, were visited on August 10th. Cape Sabine is an island at the west side of Smith's Sound, in Lat. 78 deg., 45 min.

In sailing from Cape Herschel, on the mainland of Ellesmere Land, the vessel struck heavily on a reef, and lost 75 feet of her keel, but fortunately she was sufficiently staunch to withstand this battering; but the full extent of the injury was not known until her return to Halifax.

At Cape Herschel a landing was made, on August 11th, and a document read taking formal possession in the name of the King. The Canadian flag was also raised and saluted, and a copy of the document was placed in a large cairn built of rocks on the end of the Cape.

On August 13th Lancaster Sound was entered, and on the 15th Beechy Island was visited. A record was found here showing that the Norwegian sloop "Gjoa" had arrived in August, 1903. A summary of Capt. Admundson's voyage in the "Gjoa" from Baffin's Bay to the mouth of the Mackenzie River, will be found in our report of last year.

After an inspection of relics of the Franklin Expedition and the monument, the return trip was commenced, by first crossing to North Somerset. On August 17th formal possession was taken of this large island.

The permanent Esquimaux encampments at Pond's Inlet were visited on August 19th-21st, and on the 22nd the voyage southward was commenced, but owing to fogs and ice, Cumberland Gulf was not reached until August 27th, and Blacklead Island, near the head of the gulf, on August 31st.

Port Burwell was again reached on September 4th.

Explorations were made along the south shore of Hudson's Strait, on the way to Fullerton, where the ship arrived on Sept. 16th. Leaving Fullerton on the 25th Sept., Port Burwell was reached on October 1st. Within an hour of the arrival, the "Arctic," with Capt. Bernier and Major Moodie, arrived, westward bound.

On Oct. 4th the "Neptune" started for Halifax, arriving on Oct. 12th.

Commander Low followed his instructions to the letter, going no farther north in Smith's Sound, nor further west in Lancaster Sound than his instructions warranted. It is to be hoped that the Dominion Government may be prevailed upon to send another expedition to fully explore the north-west part of Ellesmere Land, and the islands recently discovered to the west thereof and partially explored in 1900-02 by Capt. Sverdrop in the "Fram."

In the spring of 1900 Capt. Cagni, a member of the Duke d'Abruzzi expedition, attained Lat. 86, deg. 33′ N., the highest record north to that date, by sledging from Franz Josef Land. This exceeded Nansen's farthest north in 1896 by only seventeen minutes.

This record was, however, broken by Lieut. Peary on April 21st, 1906. He started on his last expedition in 1905, returning in 1906, his base being Jones Sound. His highest, Lat. 87, deg. 06, was made over the ice by sledges from the northerly end of Ellesmere Land. The open season and the bad condition of the ice prevented further progress north. He is confident that the next expedition will succeed in reaching the pole.

The Polar Research Committee endeavored to secure Commander Peary for a lecture during this meeting, but failed.

The proposed Wellsman balloon expedition across the pole from Spitzbergen, which was duly advertised to be undertaken in 1906, was deferred for another year. Whether the balloon

proved unsatisfactory, or the equipment inefficient, has not been clearly set forth.

Recent achievements in aerial navigation are certainly very encouraging, and it is quite possible that Wellsman may succeed.

Respectfully submitted,

WILLIS CHIPMAN,
Chairman.

REPORT OF COMMITTEE ON DRAINAGE.

Mr. President, -Your Committee on Drainage, though not being able to submit a report which throws much light on this vexed and important question, take credit that during the present very busy season they did not let the matter go by the board entirely. In this case the members of the Committee would no doubt be severely dealt with, and would lose all chance of being reappointed on this honorable Committee. Some correspondence passed between members of the Committee, but the first reply received by the Chairman was in response to a letter written to Mr. W. G. McGeorge, O.L.S. and C.E., one of the most highly honored and brightest members of our Association. The following is the reply, which will be received with deep grief by every one of us, who all will wish to give our tenderest sympathy to the bereaved members of the family:

"Father passed away on the first day of July of last year, after a six weeks' illness which seized him while he was away on a survey of Walpole Island."

I shall now read some very important suggestions made by some members of the Committee. These are as follows:

"I wish to call your attention to Sec. 9, Sub-Sec. 8 and 9, of the Municipal Drainage Act. It has, I believe, always been considered optional with the Councils whether, when the engineer violated these clauses, they adopted his report and paid his fees or not, but since the decision of the Court of Appeal in McKenna vs. Osgoode, a Council would hardly be safe in adopting a belated report unless the proper extensions were made, no matter how anxious they may be to do so.

"This means that there are a great many drainage reports made by surveyors at enormous expense, and which the initiating municipalities are anxious to adopt if they thought it would be safe to do so, but the surveyors, thinking that the Councils could

adopt the reports if they wish to do so, have neglected to get the extensions of time, and now cannot collect the fees. In addition to this, the lands requiring drainage must wait another year until another surveyor can be appointed and another report made. It seems to me that this is a matter that should be remedied by an amendment to the Act, and the amendment should be made retroactive or there will be serious difficulty and great loss to many surveyors.

"The common belief amongst lawyers and engineers is that it was the intention of the Act to make it optional with a Council whether it availed itself of these clauses or not, and I think it would be sufficient to have it so defined. I might add, however, that the time for filing a report should be made nine months instead of six months in the eastern district, where the winters are so long and severe. No man who takes enough drainage work to keep him alive can get his reports in in six months."

"From my observation of the working of the Drainage Acts, it would appear to me that some organized effort should be made to have them thoroughly overhauled and simplified. If my conception be correct, the original intention of the Acts relating to drainage was to enable drains to be built at a minimum of expense and formality, relying on the judgment and skill of the engineer to obtain the greatest benefit for the smallest outlay. From this they have deviated to such an extent that they are becoming merely a fertile source of revenue for the lawyers and an endless trouble and expense for those in whose interest they were framed. Every engineer engaged in drainage work has probably experienced the chagrin of having his award set aside owing to some slight technicality of procedure, or the humiliation of having it amended in a manner which he knows to be unjust, by parties wholly incompetent to form a proper conception of the matter at issue. While this state of affairs is a good thing for the gentlemen of the legal profession, the reverse is true with regard to the engineer, as parties often hesitate to take proceedings under these Acts owing to fear of the expense involved. It is also decidedly galling to take a secondary position in practical matters relating distinctly to our own profession, to persons whose arguments are built entirely of words. If legislation could be framed to permit each county to appoint a qualified engineer to act as drainage referee, with power to settle all drainage disputes arising within its boundaries, it would, I

[illegible] in the right direction. The engineers for the two [illegible] submit the case direct to such referee and have [illegible] It is this course expensive and long-drawn-out [illegible] might be avoided and the work allowed to proceed [illegible] and the expenditure of, in many cases, an [illegible] to complete the work, in law expenses. It is a [illegible] engineers that the mass of evidence taken in [illegible] shows but little light on the [illegible]

[illegible] in the preparation [illegible] lines and I will [illegible] seems to me that would [illegible]

[illegible] cases which have been [illegible] of interest [illegible]

[illegible] the Township of [illegible] costs of Construction. [illegible]

[illegible] the provisions of the [illegible] 28, for the con- [illegible] upon the con- [illegible] charge upon the lands [illegible] the respective owners for [illegible] from the owners at the time of [illegible] under the Act.

[illegible] Drains and Water- [illegible] 28, were initiated, and the regular [illegible] was duly made and filed. [illegible] forthwith notified each of the [illegible] parties made default in doing [illegible] within the time stated by [illegible] to the lowest tenderer. [illegible] thereon. The engineer in- [illegible] satisfactory, certified the [illegible] The certificate was duly filed in [illegible] and the amounts were duly paid [illegible] The defaulting party was duly notified, [illegible] charged against the land in ques- [illegible] retained the said sum out [illegible] him. The first party then

brought action in the County Court of Perth for a declaration that the said sum was not a charge upon the lands, and for an injunction restraining collection, and for an order directing the said amount to be struck from the collector's roll, 1905, as forming a cloud on the title.

The award was attacked on various technical grounds, but its validity was upheld. The main contention of the plaintiff was that although the award was binding against the first party and against her lands, while owned by her, the amount paid by the township, not having been placed on the roll till after the sale to the plaintiff, was not binding against the lands in the hands of the purchaser, and the learned County Judge so held.

The defendants appealed to the Divisional Court, and the motion was argued on February 20th, 1906, before Meredith, C. J. C. P., and Anglin and Teetzel, J. J., who held that neither party should have costs either of action or appeal, and the result was that the appeal was allowed without costs, and the judgment was reversed.

Drain. Revocable License Therefor. Damages. Easement. Prescription.

The owner of a farm consented to the water, which came through a culvert, being carried off by means of a drain, which he himself dug, through the corners of the farm, into a ravine. No written agreement was entered into therefor, nor was there any expenditure of public money thereon, nor any consideration given for its use.

Held that a revocable license merely was constituted, which the plaintiff, claiming through such owner, was entitled to revoke; and even if a valid agreement with such owner were established, it would not be binding on the plaintiff, for no notice or knowledge thereof was proved, knowledge merely of the existence of the culvert and drain not being sufficient.

Held also that the plaintiff was entitled to an injunction, the damages allowed him—$100—being, under the circumstances substantial, while the cause was a recurring one, which, if allowed to continue, might ripen into an easement by prescription.

Taylor vs. The Corporation of the Township of Collingwood (1905), 10 O.L.R. 182.

Drainage of Lands. Pumping machinery. Negligent operation of lands injuriously affected by. Damages. Persons whose

[illegible]

drainage of all lands within the area of the proposed work, and may vary according to difference of elevation of the respective lots, the quantity of water to be drained from each, their distances from the work, and other like circumstances. Section 75 of that Act only authorizes an assessment for repair and maintenance of an artificially constructed drain. The cost of widening and deepening a natural watercourse for the purpose of draining lands is not assessable upon particular lands under said Section 75, but must constitute a charge upon the general funds of the municipality. In the present case the scheme proposed was mainly for the reclamation of drowned lands in a township on a lower level than that of the initiating municipality, and such works are not drainage works within the meaning of said Section 75 for which assessments can be levied thereunder, nor are they works by which the lands in the higher township can be said to have been benefited. The Sutherland-Innes Co. vs. Township of Romney, 30 S.C.R. 495.

Drains. Increasing flow of natural stream. Joint tort feasors.

The owner of land on the banks of a natural stream has no legal ground of complaint if riparian owners above him reasonably use the stream as an outlet for drains made by them in the agricultural use of their lands, although the result is to increase the amount of water in the stream and to flood part of his land. But this principle does not apply to persons not riparian owners, who by proceedings under the Ditches and Watercourses Act obtain an outlet to the stream, and they are liable to the person injured by the increased amount of water.

A proper outlet under the Ditches and Watercourses Act is one which enables the water to be discharged without injuriously affecting the lands of another, and if the outlet chosen by the engineer is not in fact a proper outlet, his award is no protection to the persons acting under it as against a person not a party to it.

An action to recover damages for flooding his land was brought by a riparian owner against a number of persons who were respectively parties to the construction of several drains under the Ditches and Watercourses Act, the allegation being that by means of the drains the flow of water had been unlawfully increased to the plaintiff's injury. Evidence was given as to the quantum of the plaintiff's damage, and judgment was given all the defendants for the whole amount.

Held that only the defendants who were parties respectively to the construction of each drain were jointly liable for any damage attributable to that drain; the different sets of defendants were not joint tort-feasors and had been improperly joined as defendants; that a joint assessment of damages was improper, and that, there being no evidence of the proportion of damage attributable to each set of defendants, only nominal damages and an injunction could be awarded.

Judgment of the Drainage Referee varied. McGillivray vs. Township of Lochiel, 1904, 8 O.L.R. 440.

Some of the points brought out in the foregoing cases are quite simple and clear, but others will require a good deal of study and a careful consideration of the cases in full as reported.

All of which is respectfully submitted.

GEO. ROSS,
Chairman.

REPORT OF AUDITORS OF ONTARIO LAND SURVEYORS' ASSOCIATION.

To the President and Members of the Ontario Land Surveyors' Association:

We have made the annual audit of the bank accounts and cash, with the books and vouchers of the Secretary-Treasurer of the Association for the year ending the 26th of February, 1907, and we hereby certify that the financial statement is correct. We find that the books and accounts are carefully kept and that the statement clearly shows the financial standing of the Association.

L. V. RORKE.
W. A. MCLEAN.
Auditors.

REPORT OF COMMITTEE ON ENGINEERING.

Your Committee on Engineering beg leave to submit the following report:

Considering the number of members of the Association engaged in engineering work it is to be regretted that more papers have not been contributed in relation to engineering subjects.

Several papers were promised, and even the title of the paper given, but for some unexplained reason they were not forthcoming.

Your Committee think it advisable from time to time to direct the attention of the members to any especial occurrences or features in engineering work or practices, and in this connection we would mention the serious damage which is now being done to water, gas and other metallic conduits by the escape of current from the electric railways, especially where the single trolley system is in use. This is of particular interest to city and town engineers, and we think steps should be taken at once to check the damage, which no doubt is silently taking place. Your Committee find that a very large number of the members of the Association are engaged or partly engaged in engineering work. All of which is respectfully submitted.

E. G. Barrow,
Chairman.

REPORT OF THE COMMITTEE ON REPOSITORY AND BIOGRAPHY.

Your Committee on Repository and Biography, while having little definite to report, desires to keep before the Association the question of improving our present rooms or securing more suitable accommodation. The matter, although not at present urgent, is one that offers some difficulties in its solution, but upon a careful decision much of the future welfare of the Association will depend. The rooms now occupied have been much used throughout the past year, by out-of-town surveyors having business at the Parliament Buildings. The library and valuable charts belonging to the As-

sociation are frequently referred to, but no additions of note have been made during the year.

Respectfully submitted,

W. A. McLEAN,
Chairman.

REPORT OF COMMITTEE ON PUBLICATION.

Your Committee on Publication for the Association year 1906-7 beg to report as follows:

The work of publishing the Annual Report was awarded to the Stevenson Printing Co. and the greater part of the material was in their hands early in the year. Good progress was made [illegible] by reason of pressure of personal business on the part of those with whom the Publication Committee worked, a change to [illegible] was not made until later in the season and then [illegible] impossible to promptly execute the work [illegible]. For these reasons the issue of the 1906 [illegible] was later than the [illegible] previous year.

[illegible] the Committee should be appointed will [illegible] the [illegible] that their predecessors [illegible].

The [illegible] 35 copies at the cost of $514.30 was [illegible] among our members [illegible] over the publishing [illegible] the insertion of a [illegible] the fact that the [illegible].

Respectfully submitted,

[illegible] NOSTRANT,
Chairman.

REPORT OF COMMITTEE ON ENTERTAINMENT.

Mr. President, it was the pleasing duty of your Committee to arrange the 29th Annual Dinner of the Association, which [illegible] McBride's Restaurant, Toronto, on the 1st March,

1907. There was a good attendance of members, and the guests were also numerous. The chair was occupied with dignity by our distinguished President, Mr. Otto Klotz, and the vice-chair by Mr. Thomas Fawcett, our genial Vice-President. In the unavoidable absence of the Minister of Lands, Forests and Mines, his place was ably filled by his Deputy, Mr. Aubrey White. The usual loyal, political and social toasts were proposed and responded to, and the hearty singing of inspiring songs gave a pleasant and cheerful tone to the evening, which passed quickly.

We were agreeably enlivened by some thoughts of our old friend, Mr. E. C. Easy, C.E., upon the position of the lady engineer. These we reproduce below.

The entertainment was closed with "Auld Lang Syne" and the National Anthem.

Respectfully submitted,

KILLALY GAMBLE,

Chairman.

"YE LADY ENGINEER."

(Being a reply to the Secretary of the Engineers' Club of Toronto.)

BY C. M. CANNIFF.

(Illustrations by W. Van R. Reynolds.)

Dear Sir,—Your communication of the 20th ult., announcing my appointment to a Special Committee to report upon the admission of lady members, duly received. As requested, I have carefully noted the information given, as follows:

Item 1. Prof. Starr, of Chicago University, in a very widely reported lecture, declares that women students have a stronger grip on mathematics than the men, and that the men are more emotional than the women.

Item 2. The "Technical World," October, 1906, announces that Miss Nora Stanton Blatch has been elected to membership in the American Society of Civil Engineers; also that

Item 3. The University of Colorado has recently graduated its first woman engineer.

Item 4. A late "Engineering News" records the fact of Miss Elsie Bittman having vacated a $1,200 draughting position in the New York City Bureau of Highways for an assistant engineership on subway construction.

Now, Mr. Secretary, if you will allow me a few lines in which to air my views upon the foregoing, you will partially excuse, I hope, my slowness in deciding to act on this Special Committee.

The facts set forth in your letter presumably are intended to convince me that the old order is changing, and that it devolves upon the Club to act in recognition thereof. There certainly does seem to confront us some necessity for alteration in the scheme of things entire—nowadays when we can sit at home and listen to Patti and Melba sing vulcanized rubber songs merely by twisting a crank. But, if it comes to that, where are the copper buns of yesteryear; whither vanished the old-fashioned, parti-colored sugar stick of tooth-irrigating memory? The stage and the old grey mare going out, and the railway and motor car coming in, means, as someone says, that we arrive at places now, we travel no more. Our pet theories, too, are exploding one by one—deny it we cannot. Modern research is seeking to impugn the rosy cheeks of Newton's apple; to repeal the very laws of gravitation, despite the evidence obtained by the centre of gravity of our waistcoats in a Trader's Bank elevator. Waterfalls, we have discovered, have other uses than to form picturesque pickerel pools; they who seek them out at present writing are promoters and their engineers, and have other fish to fry. But what of the matter more particularly in hand? It seems, then, that in the land to the south they are rushing it to the limit—this *Age* which answers to the equation of—

Criss-cross + catacorner = F + topsy-turvy + higgledy-piggledy; F being a constant representing the date, last past, when the moon was at the full.

In other words, a dimpled trio of comeliness—after publishing the banns for four academic years and a post-graduate course—has become wedded to the engineering profession, following the example of others of the fair sex, who, in other lines, have been united in the holy bonds of making money. They have gone Dr. Mary Walker one better; such appears to be the case.

For my part, wondrous had it seemed had some giddy young damsel in fluffy bangs, beholding lady doctors and lady lawyers and lady such-and-such—every one prospering—not grown clamorous, not longed to conquer the realms of practical scientific intellectuality; to take things out, as it were, to the "henth" power; not yearned to be a mining expert, for example, to go romping

after rugged rocks with dinky, diminutive hammer, or to practic civil ingenuity, perchance to prod into the vital statistics of sewers and pavements and septic tanks and so forth, and do telescopi stunts for a microscopic sa ary, while figuring on th *dramatis persona* of a Gov ernment survey, just lik many of the lords of creatio I could have told you s Satan finds some mischo still for the hand that rock the cradle.

This Chatauqua busin was bound to be overc Airy, fairy Lillian, one s cultivated a bowing acqua ance with long-legge wo ending in *-osity* an would be sure to purs downward path, and ere long stumble against an introd to specific gravity and voltage and such like. When menced seeking the mother-lode of erudition, from acqu Latin word for a water-beetle—don't you know to read iodicals infested with higher mathematics, and cultivati for strength of materials and conic sections, the gradie ably easy. The seed had been scattered, the soil w one had but to squat on a roadside stump and take of the harvest.

While still in frocks that flirted with their boo read their Tennyson—these saucy, winsome lassi p him all by rote, most of them, and in a desire to thro yoke of kitchen vassalage" can you marvel that their skirts and jumped the fence into the engi there any reason why they could not take 2 and them together, and dally just as learnedly a finished product. Nay, nay, Pauline. Not

So, from her mother's kitchen my la the school of technology and the laborator anent the intricate fusing of metals, eati ledge of the *entente cordiale* between Sod getting wise to the proposition that Cobar in the same set.

It was only the merest step from t ruler; from being a dab at domestic

functions algebraic—the slitheriest sort of lubricated transition; from being chief push at a Domestic Science meeting to reading a paper on some such subject as "Reinforced Cow-meat" was like sliding off a log. Fish-plates and fashion-plates are confusing in shorthand. Beet roots and cube roots nearly are allied.

Looking abroad, then, and rolling a melting eye, and rubbing shoulders with successful female barbers and dentists, it was nothing but natural for some ambitious Alice, or Priscilla, or Phyllis, or Eunice, to hazard a bet in an idle moment that she would yet reach the head of engineering navigation, and snub fast in one tender, loving hug of exceeding largeness, to the fat salary that environs the crafts and subtleties of the consulting engineer.

The men have only themselves to blame, perhaps. Here, for years they have been practising deceit. The ladies were sure to find out after a time that a dam is not merely a long, low, splashy-looking thing with green moss and poetry and stuff on it, where the boys have their swimming hole; but also that good money may be made at home by figuring and making plans about it before it is built and flops over. Nobody likes being gammoned, and that's why the gentle, adorable Doris is elbowing the men and stooping to the profession—why woman, lovely woman, is bringing herself down to a mere man's level, and transit.

There is no use telling the dear creatures, these sweet and radiant handmaidens of Science, what they are up against, I suppose. If they knew the tariff charges, unless I miss my guess, it would be a kissing game of good-bye to the civil enginine. However, as the profession claims as many different varieties as Heinz's pickles, it may be assumed that there's a lot of gentle-eyed gazelles perched on the verandah and watching to see if this first bunch of beauty makes good before taking the plunge. If one brand doesn't seem appetising, there's a lot of others left. That's doubtless what they think. Ruth crushed to earth will rise again. But, being kind-hearted, I sadden, I hasten to drop the unfeigned tear! Could a thought more hateful than leaving them to fry in their own fat be imagined?

I suppose the whole crusade started with that disinherited tradition about the Transit of Venus, and how Venus laid out the Milky Way, and the further discredited idea that she gave her

arm to make the third leg of the tripod. Or have they gone crazy from playing bridge?

Mercy me, what wielding of logarithms with the energy that should flow in full, free, fast flood, undefiled, toward the carpet sweeper! What cluttering of feminine brains with labyrinthine formulæ! What acquisition of wrinkles over Chambers' Tables when the time were better employed in ironing wrinkles out over the tables in the laundry, must ensue, ere these poor, deluded but beautiful blossoms of loveliness realize their mistake, acknowledge that it is better far to know how to scale a nice fresh herring than a plan—not to say, bake a tapioca custard than cook field-notes.

After all, my dear Mr. Secretary, the point I make is, that what has come to pass is not in our own country. The germ has been isolated and propagated, let us admit, more or less successfully under the Eagle's wing; but it is all experimental, and from Uncle Sam's domain to ours is a far fly. Upon mature deliberation I consider the Club unduly excited and tanbarking up the wrong tree. I grant, of course, the advent of a new era, and that Canada is going to loom large; that "with enormous untouched natural resources," etc., already has she begun to bring her pigs to market—and billets, too—and that no longer will we sit down and say grace over bare bones. All of which signifies that the day of the engineer and surveyor is here.

It is true that many young ladies have come from Toronto University with the centre B and distance B.A. in their bonnets—have done so for years—but reading Moderns, and Kant, and messing round the fourth dimension and such like, is different to having technical and mechanical fal-da-rals seething in your brain-pan. If a fellow like me, who is trying to get three squares a day out of engineering, may be permitted to have such grave, mighty thoughts locking through his cogitatory canal, I should say that our maidens can be *tête-a-tête* with Macaulay and Gibbon without interfering with the artistic *tout ensemble* of the stuffed canaries on their Sunday morning hats; yet that these same sweet lady graduates are too sensible to fail to understand how the paths of survey lead but to grey hairs; how working fakes with a lathe, or frivoling with bridge construction,

or twisting on or off the juice in a power house, are things better left to brother Tom. We bring our daughters up better. We do not want to be reading advertisements of "Maiden Canada" engineers.

There is the eternal fitness of things to be considered, despite the fillip given to some minds by the quaint, the unexpected. A "Madonna of the Sand Pump" would not look right. Resolved, that a horn spoon is the best for the mustard pot; also that ginger beer tastes better from a stone bottle, whilst the ordinary hayfield variety of beer—accepting the knowledgeable dictum of the immortal Bob Sawyer—yields its ultimate strength, imparts its most delicious, nut-brown quintessences to the wetted perimeter known as the right spot, only from "its native pewter." Nay, a plumb-bob would not feel at home waggling at the end of a corset string. It is all very well for the "Technical World" man to get busy and make statistics for printers' copy. But stop for a moment and consider the absurdities of it all!

Picture your draughting office! A dainty, demure, tender dove of a damsel over there in the corner, with a prodigal wealth of auburn tresses her head adorning, and a truncated cone of ditto behind—impressionable, she, as a fresh-trowelled concrete walk—just fancy her, intent plotting curves for permeability and calibration or efficiency and power factor, or some other thing, and lining her snow-white, patrician brow till it resembles a terminal yard; the fair, pure oval of her face tuck-pointed from chewing gum; with it all an intangible yet pervading aroma of lavender or new-mown hay in the air! Is't not a presentment to set you a-dreaming of lyrics and sonnets and strophes! "And they called her Maud." The drawing room! "Imagination fondly stoops to trace the parlor splendors of that festive place," as per the poet. What a shape your papers would get into—estimates jabbed together with safety pins and what not. Under the regime of one's able assistant, Miss Fluffy Ruffles, Spinster of Applied Science, would not one's reports and specifications have more postscripts than a steel tape gets kinks? Just think, think—let your fancy have play—the walls! Bunches of celluloid set squares and French curves tied up with baby ribbon. My very soul is harrowed. What insertions in the drawing paper, what tucks taken in the

cross-sections, what three-inch pleats in hemstitched profiles, would signalize the invasion of sighing Jean, or cooing Dolly, in her Peep-a-view shirt waist, and side-stepping hither and thither, flaunting, fluttering—with a mouthful of drawing pins! 'Ods precious; only conjure up the stuff you would always be finding on your best embossed letter-paper after she had gone for the evening, an' it please you. She would set up her muse, and level it, and run "Lines to a Gravel Pit" after some such fashion as:

> "Oh, to be carted away
> From this dark Aceldama of sorrow,
> Where the gravel and sand of to-day
> Becomes the concrete cub. yd. of to-morrow."

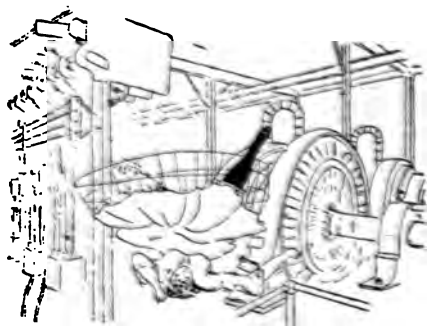
Would you like that? Would it be seemly? I grant that plenty of our draughtsmen lack the brains of a horse on a milk route, and that now and again one might count on an artistically-minded female who could manage a plan which when completed didn't look as though its necktie were up over its collar, but—my word for it—the lady draughtsman is yet a long way off. Do you think they would ever date a drawing? No, the betting is 20 to 1 against pink T-squares. There are too many other congenial occupations—if they will not stay at home and help mother, and recreate with *Trolley-era Rusty-piano* sort of music when Mr. Smithkins calls of an evening—too many vocations for them to confess to any wistfulness for a bridge, or languishment for a five-mile breakwater, or love for a septic tank, or desire for a bevy of culverts. And if the Engineers' Club is serious it surely must be holding the telescope to its bad eye.

Their common sense will teach the ladies that digging ditches and cumbering the earth with viaducts are not for the likes of them. Our Lady of the Snows (be the last same, more or less) has no hankering to go roaming up and down creation jabbering about test-tubes, and assays, and load-factors, and shaft-sinking, *et al*, like a lather with a mouthful of nails. They recognize that a pretty girl and plane trigonometry—be the moon ever so lovely—are incompatible, incongruous.

Why, the idea is so silly! First thing, we'd be having "Rules of Professional Etiquette on Sewer Work," and a new column in the "Ladies' Home Journal," headed "Complexion Aids for the Field." The longer I ponder the whole proposition, the more decided I become.

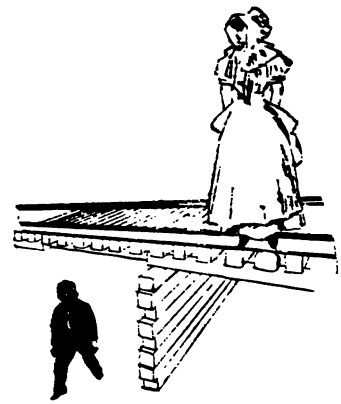
Hark! list!—do you hear the pathetic, undertone query, "Is my instrument on straight?" Ludicrous, crazy, the entire hypothesis!

Behold Gladys Edythe—tricksome goddess, serenely sweet—wrestling on a cold, windy day with the thumbscrews, in a pair of No. 6 suede gloves, the whiles her dainty tailor-made gown plays clothes-line with the tripod. Gaze on her trying to negotiate the elusive cross-hairs, what time her feather is frisking between the bubbles like the swipe of a Newfoundland dog's tail. . . . I believe that there are a lot of other girls who affect squashy, deep-apple-pie kinds of headgear, with a chop suey adjunct of violets, or assorted fruits, or something clinging to the soffit of its *porte cochere;* but if we can imagine a lady surveyor or engineer at all, in either case—if she were giving line and got mad and tore it off and threw it down and jumped on it—the resultant would be the same by the graphical method.



Suppose crinolene to come in, and Alicia in a power plant! She'd go fooling about — blonde curls, cunning curls—get caught in the shafting or make a short skirtlet, and just then things would be hooping up generally.

Think of her measuring on a trestle, with notebooks and powder puff, and tape and pencils, and red chalk and smelling salts, and the usual incidentals in her chatelaine. She'd be yelling in a rich, deep mezzo-soprano to Kelly, the foreman, to yank those ties off quick, or get to the calorific equivalent out of that. Would Kelly, think you—whose language, when he is caught without an umbrella in a brain-storm, is often so bad that his mouth needs a mud-guard—be apt to study fastidiousness in his repartee to those pearly cadences issuing from those ruby lips? Deponent sayeth not, nor yet putteth it in writing.



The foregoing, my dear Mr. Secretary, are but the more obvious things that occur to me. I am not going into delicacies. But love my heart alive, would not every survey demand a chaperone? Ye gods, what a vision!

No, doubloons to ditch-water, 'twill be a long, long day ere the saying changes to "Oh, for blue prints like my mother used to make." The civil enginine's contract is too much inclined to *embonpoint*, and we need fear no foe in the guise of a moth-ball rolling care-free in the tracing-cloth drawer. Winging to covert in the technical section of the "Idle Rich" is a grown man's job.

And all of the above, Mr. Secretary, makes me opine that the Engineers' Club need not let worry sit too heavy on its chest. After reading same, if you still think the Committee necessary, and that it's up to me to act, you have only to say the word.

With best wishes, believe me,

Yours truly,

E. C. Easy, C.E.

[illegible] ADDRESS

[illegible] Association of Ontario Land Surveyors

[illegible]

them to fruition—for without their services there can be no material progress, but only stagnation. We can truthfully, and without exaggeration, say that no profession contributes more to the advancement, development and progress of a country than does ours.

It is gratifying to be able to record, too, as I personally can, to the higher standard attained and still aimed at by the profession. Armed with the standard of twenty years ago, we would find our implements thoroughly inadequate to cope with the many and varied questions that are presented to us for solution. Professor Galbraith and his able staff are doing a national work of the greatest import in training men to grapple with the many problems that present themselves in our growing country, which one may liken to a giant flower, its seed lying dormant for past generations, but now the buds by the thousands are bursting through, seeking light and sunshine, to develop into a galaxy of blossoms under the fostering care of sturdy Canadians.

The bud that has developed the most during the past year is the Cobalt "bloom." This flowery product has, however, associated with it matter less poetic, yet of more material concern to man; I will mention the name, as so few of us see or have much of it—silver. If there is one phase of the wealth of the Cobalt district in which I rejoice, it is the revenue that the Ontario Government is receiving therefrom, enabling it thereby to support the Provincial University adequately; to promote education in general, and especially to implement its support to the School of Applied Science and Engineering, not forgetting an adequate and just compensation to the professors and teaching staff, who have been lamentably underpaid.

Strange as it may appear, yet it is true that man places the least value on human life. He will exercise the greatest care and discrimination and attention on his thoroughbred horse or cow or sheep or dog, provide for their health and comfort, but for the genus homus less consideration is shown. I refer especially to the question of sanitation. With the general progress manifest throughout the land, there is an awakening that smaller places, villages and towns, should be possessed of sewage and waterworks, and this has opened new fields for many in our Association. Closely allied thereto is our drainage system for marshy and swampy lands, whereby not only land is reclaimed for agricultural purposes, but a menace to the health of the community as breeding places of malaria is removed.

The increased value of land, whether urban or of the farm, together with the higher standard of accuracy aimed at by the

profession has relegated the old iron Gunter's chain to the museum and replaced it by the steel tape.

The surveyor has well kept abreast of the demands of the country for efficient work, but in general his reward or remuneration has not kept abreast with the prosperity of the country, with the increased cost of living, and with the value of the services rendered. But this is a matter wholly in your own hands. Make yourselves cheap, and the public takes you at your price. On the other hand, be conscious of your merit—justly, of course—and the public will recognize it.

We are in a fair way of having ere many years the older part of the Province covered with a primary triangulation net, so that the land surveys, including municipal, topographical, in short, all kinds of survey, will be based on fixed positions, and thereby give a definiteness and homogeneity that is now so sadly lacking.

It is most gratifying to find that our finances are in a most healthy condition, which augurs well for the health of the corporate body.

I regret that we have to record the death of four of our members since the last meeting, viz., Mr. Abrey, Mr. H. Bigger, Mr. Spry, and lately of Mr. Hermon. With the exception of Mr. Bigger, who was one of the most promising of our younger members, the other three were all men of large experience, and occupied honored positions in the profession. Of these we may say: "Well done, good and faithful servant."

In conclusion, permit me to say that in no country is the professional standing of the surveyor higher than that of the Ontario Land Surveyor.

PAPERS.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

THE MEASUREMENT OF BASE LINES WITH THE STEEL TAPE.

BY L. B. STEWART, TORONTO.

Professor Jäderin, of Stockholm, was the first to experiment with the steel tape as an apparatus for the measurement of geodetic base lines. In 1879 he published his first memoir on the subject, a translation of which by Prof. J. Howard Gore is contained in the Report of the U. S. C. and G. Survey for 1893; and since that time the steel tape, or some similar substitute for it, has gradually gained the confidence of geodesists, until at the present day it has almost superceded all other forms of base-measuring apparatus, owing to the precision and economy of its results.

Jäderin used a narrow tape, 20 metres in length, in his first experiments, but finding that it exposed too large a surface to the wind, he soon substituted wires of steel and brass for the tape, reserving the latter for fractional lengths only. In making a measurement the end of the tape rested on tripod supports placed a little less than a tape-length apart, the positions of the ends of the tape being marked by means of fine needles placed vertically in the upper surfaces of the tripod heads; the rear end of the tape was held firmly with its zero mark in coincidence with the needle of the rear tripod, while the forward end was stretched with a constant tension applied by means of a spring balance, and the position of the needle of the forward tripod was noted on the millimetre graduation of the forward end of the tape.

It was necessary, then, to apply to the length thus observed corrections for sag, tension, grade and temperature; and the first two corrections named being of opposite sign, a tension was determined that made them cancel one another, and this was the standard tension used. The temperature of the wires, when they were used in the measurements, was determined by their differential expansion, duplex measurements being carried on with the two wires, which had been previously carefully standardized. In thus using two wires of different materials as a metallic thermometer, it is assumed that their temperature is always the same, an assumption that probably is seldom realized in practice.

Another correction that must be applied when the tape or wire is used at a different elevation than that at which it was standardized, is that due to the change in the force of gravity. The effect of this change depends upon whether the tension is applied by means of a weight or by a spring balance. In the former case the tension is changed without altering the sag; in the latter the sag only is changed.

Jäderin's results showed a high degree of precision, demonstrating clearly the advantages of the method.

The steel tape has been used very extensively of late years on the U. S. Coast and Geodetic Survey. In the report for 1901 is given an account of the measurement of nine base lines along the 98th meridian by A. L. Baldwin, the chief of the party that carried on the work. Tapes 50 m. and 100 m. in length, two of each, were used. Stakes were driven into the ground to mark the terminal points of the tape, and also intermediate stakes at every 10 m. to serve as supports for the tape, which rested on nails driven into the sides of the supporting stakes. Tension was applied to the tape at its forward end by means of a spring balance, a standard tension of 30 lbs. being used throughout, and the precise positions of the ends of the tape were marked by fine lines ruled on copper plates nailed to the tops of the terminal stakes. The tapes were all standardized in the field by comparing their lengths with a 50 m. or a 100 m. comparator measured by means of the iced bar base apparatus. The tape during a comparison was supported and stretched in the same manner as during a measurement.

In addition to the steel tapes the duplex bar base apparatus was also used in the measurements. It was standardized in the field in the same way as the tapes. One kilometre of each base, called the test kilometre, was measured with each apparatus, and if any measure showed a residual from the mean exceeding 17 millimetres, the apparatus with which the measurement was made had to be re-standardized.

By a comparison of the probable errors in the lengths of the bases with those of the border lines of the base nets in the transcontinental triangulation, it was found that the latter were from two to five times as large as the former, each expressed as a fractional part of the whole, showing that the precision of the base measurements was out of proportion to that of the angle measurements. It was therefore adopted as a guiding principle in the base measurements along the 98th meridian, that there is no advantage to be gained by increasing the precision of the base measurements beyond that represented by a probable error of one part in 500,000; that it is a wiser policy to increase the speed of measurement and the number of bases, rather than to increase the

precision of a fewer number of bases placed at longer intervals apart. Notwithstanding this restriction, however, the average precision of the base measurements in question was that represented by a probable error of 1:1,200,000.

The most serious source of systematic error in all linear measurements is due to the difficulty in determining the temperature of the measuring apparatus, and thence the correction for expansion. To overcome this difficulty various expedients have been tried, such as the various forms of apparatus, in which the differential expansion of bars of different metals is used to keep the distance between two points in the apparatus uniform under changes of temperature, or to indicate the temperature. All these expedients, however, have met with only partial success. It is a noteworthy fact that in the discussion of the measurement of the Salt Lake base of the transcontinental triangulation, a closer accordance in the measurements was obtained by using the temperatures indicated by the mercurial thermometers than by using those given by the duplex bars of the base apparatus.

The final solution of this difficulty probably rests with the use of Guillaume's alloy invar in the construction of base measuring apparatus. The composition of this alloy is 35.7 per cent. nickel and 64.3 per cent. steel, and it has an extremely small co-efficient of expansion. During 1906 the officers of the Coast and Geodetic Survey made several experiments with invar tapes to compare the results obtained with them with those from steel tapes. They measured six base lines, using on each base three invar tapes in daylight, which had been standardized at the National Bureau of Standards, and three steel tapes at night which had been standardized in the field. The steel and invar measures were computed independently and the differences between them were small, the average being 1:500,000. The probable errors of the lengths of the bases found from the steel tapes are more than double those from the invar tapes, and the final probable errors of the bases, giving the invar measures double weight, are between 1:2,500,000 and 1:5,000,000, or 0.4 mm. and 0.2 mm. per kilometre. The coefficient of expansion of invar was found to be .0000004, or 1-28th that of steel.

These results prove conclusively the advantage of invar tapes. In 1900 the C. and G. Survey proved that steel tapes gave practically the same accuracy as bars, at one-third the cost; it is now shown that invar tapes give results considerably more accurate and economical than steel tapes.

A description will now be given in detail of a method which differs essentially from those above described, in the manner in which the corrections for sag, tension and grade are determined,

and which, judged by experiments made at the School of Science, promises to give as good results as the other methods. It is the result of an attempt to devise a method of measuring base lines with the ordinary appliances which the surveyor finds at his disposal with a precision at least approaching that required for geodetic base lines, but I see no reason why, with the aid of a few extra appliances, the method should not be susceptible of as high a degree of precision as will meet all requirements.

As in Jäderin's method, tripods are used to mark the ends of the tape in carrying out a measurement, the zeros of the tape being brought to coincide with fine lines, ruled on the upper surfaces of the tripod heads, the tape being suspended freely between the tripods. While held firmly in this position measurements are made to determine the height of each end of the tape above its lowest point. This is done by taking level readings on a graduated rod held first beside the tape at its lowest point—the rodman at the same time noting the height of the tape on the rod—and then on the head of each tripod. Assuming that the form of the tape is that of the catenary curve, the correction for sag, grade and tension can be computed from the data furnished by these measurements. The temperature is noted in the usual way by means of thermometers suspended near the tape.

In the base measurements made at the School of Science the tension was applied to the tape by the aid of ordinary ranging poles passed through loops in cords attached to the ends of the tape. The points of the poles were pressed into the ground by the tapemen, who then held the poles firmly with the zeros of the tape in coincidence with the lines on the tripod heads, while the rodman noted the height of the lowest point of the tape on the rod. They could then relax their attention while the level readings were taken.

For computing the various corrections, certain constants of the tape must have been previously investigated, viz., its weight, its extension under a given pull, its coefficient of expansion, and the temperature at which its length is standard. All these constants were investigated in the case of the tape used in the work above referred to, which was an ordinary 100-ft. steel tape made by the Lufkin Rule Co.

The formulæ by which the various corrections are computed will next be developed.

The principal properties of the catenary curve are contained in the following equations, for which reference may be made to any work in which that curve is investigated:

$$s = a \tan \theta \tag{1}$$

$$x = a \log (\sec \theta + \tan \theta) \tag{2}$$

$$y = a (\sec \theta - 1) \tag{3}$$

$$T = w (y + a) \tag{4}$$

$$a = \frac{s^2 - y^2}{2y} \tag{5}$$

in which

x and y = the coordinates of any assumed point referred to rectangular axes which are, respectively, a horizontal and a vertical line through the lowest point of the curve.

s = the length of curve from the origin to that point.

θ = the angle which the tangent to the curve at the point makes with the axis of x.

a = the length of curve whose weight is equal to the tension at the origin.

T = the tension at the point.

w = the weight of a unit of length of the curve.

To find the correction for sag we have from equations (1), (2) and (3):

$$\frac{x}{a} = \log\left(1 + \frac{s + y}{a}\right)$$

on expanding which and reducing and substituting the value of a from (5) it becomes:

$$x = s - \frac{2}{3}\frac{y^2}{s} - \frac{2}{15}\frac{y^4}{s^3} -$$

or

$$s - x = \frac{2}{3}\frac{y^2}{s} + \frac{2}{15}\frac{y^4}{s^3} + \tag{6}$$

If now s be the total length of the curve between two points at the same elevation on opposite sides of the lowest point, and therefore at equal distances from it, and x its projection on a horizontal plane (6) becomes

$$s - x = \frac{8}{3}\frac{y^2}{s} + \frac{32}{15}\frac{y^4}{s^3} \tag{7}$$

If $y = 1.5$ ft. and $s = 100$ ft., the second term in (7) is but 0.00013 in.,

and as the sag of a tape 100 ft. in length, and weighing about two lbs. under a tension of 25 lbs. is about 7 inches, we may safely neglect the second term of (7) and write the correction for sag

$$c_s = \frac{8}{3}\frac{y^2}{s} \tag{8}$$

As the ends of the tape are here assumed to be at the same height, we must derive an expression for the correction in the general case in which the heights are different. Denoting the heights of the ends above the lowest point by y_1 and y_2, we have by equation (6)

$$c_s = \frac{2}{3}\left(\frac{y_1^2}{s_1} + \frac{y_2^2}{s_2}\right)$$

s_1 and s_2 being the corresponding partial lengths. To find a relation between s_1 and s_2 and s we have from (1) and (3)

$$y = s\frac{\sec\theta - 1}{\tan\theta}$$

and $$\sec\theta = (1 + \tan^2\theta)^{\frac{1}{2}}$$
$$= 1 + \tfrac{1}{2}\tan^2\theta - \tfrac{1}{8}\tan^4\theta +$$

$$\therefore \quad y = \frac{s}{\tan\theta}\left(\tfrac{1}{2}\tan^2\theta - \tfrac{1}{8}\tan^4\theta\right)$$

$$= s\left(\tfrac{1}{2}\tan\theta - \tfrac{1}{8}\tan^3\theta\right)$$

$$= s\left(\tfrac{1}{2}\frac{s}{a} - \tfrac{1}{8}\frac{s^3}{a^3}\right)$$

or approximately

$$y = \frac{s^2}{2a}$$

$$\therefore \quad y_1 = \frac{s_1^2}{2a} \qquad y_2 = \frac{s_2^2}{2a}$$

and $$\frac{s_1}{s_2} = \frac{\sqrt{y_1}}{y_2}$$

$$\therefore \quad \frac{s_1}{s_1 + s_2} = \frac{\sqrt{y_1}}{\sqrt{y_1} + \sqrt{y_2}}$$

or

$$s_1 = s \frac{\sqrt{y_1}}{\sqrt{y_1} + \sqrt{y_2}}$$

$$s_2 = s \frac{\sqrt{y_2}}{\sqrt{y_1} + \sqrt{y_2}}$$

$\therefore$ substituting in the expression for c_s and reducing we have

$$c_s = \frac{2}{3} \frac{Y}{s} \tag{9}$$

in which

$$Y = y_1^2 + y_2^2 + (y_1 + y_2)\sqrt{y_1 y_2} \tag{10}$$

Equation (9) also corrects for grade.

To compare the precision of the above method of finding the correction for sag with that found from the tension applied at the end of the tape, we take the expression

$$c_s = \frac{s}{24} \left(\frac{W}{T}\right)^2$$

which gives the correction in terms of T, the tension, and W, the weight of the tape; and assuming $W = 1.3$ lb. and $T = 15$ lbs., we find that $c_s = 0.0313$ ft. Substituting this in (8) we find the corresponding value of $y = 1.1$ ft. Assuming now an error in y amounting to 0.01 ft., the resulting error in the correction for sag is 0.0006 ft., and it is found that this error would be produced by an error of 0.14 lb. in the measured tension. It is evident then that an ordinary spring balance would not give an equal degree of precision.

To find the correction for tension let

e = the extension of unit length due to unit pull,
then the required correction is

$$c_p = e \int_{-s_2}^{s_1} T \, ds = e w \int_{-s_2}^{s_1} (y + a) \, ds$$

$$= e\,w \int_{-s_2}^{+s_1} \left(\frac{s^2}{2a} + a \right) d\,s$$

$$= e\,w \left(\frac{s_1^3 + s_2^3}{6a} + a\,(s_1 + s_2) \right)$$

$$= e\,w\,s \left(a + \frac{s_1^2}{6\,s} - \frac{s_2^2}{6\,s} + \frac{s_2}{s} \right)$$

Then substituting the values of s_1 and s_2 given above, and reducing this becomes

$$c_p = e\,w\,s\,a \left(1 + \frac{2\,Y}{3\,s^2} \right) \qquad (11)$$

The second term in this is seldom appreciable. It is to be observed that $e\,w\,s$ is a constant for a given tape; a may be found by the formula

$$a = \frac{s^2}{2\,(y_1 + y_2)} \qquad (12)$$

A table may be formed giving the values of $\frac{1}{s}$ and a for assumed value of y_1 and y_2, from which their values may be taken by interpolation.

The correction for temperature is

$$c_t = s\,\alpha\,(t - t_0) \qquad (13)$$

in which

t = the observed temperature.

t_0 = the temperature at which the tape is standard.

α = the coefficient of expansion.

Applying the above corrections, we have then for the horizontal distance between the zeros of the tape when resting on the tripods, as above described:

$$x = s_0 + c_p + c_t - \frac{2\,Y}{3\,s} \qquad (14)$$

in which

$$s = s_0 + c_p + c_t$$

though s may usually be assumed equal to s_0 in computing the last correction.

Several measurements of a short base line have been made by parties of students, using the above method, and the results have been such as to show that in the hands of a well trained party a high degree of precision may confidently be expected.

DISCUSSION.

Prof. Stewart—That is all I have written. I might say that this method was tried on the field on two different occasions, and some students who had no previous experience or training made the measurements. Two measurements were made for a base line of 1,000 feet in length or a trifle under, and the difference found on the two occasions was found to be 1-100 of a foot. From those experiments it seems with a carefully trained party of half a dozen that measurements could be made that would compare favorably with other methods used in measuring geodetic base lines. (Applause.)

The President—I have listened to the paper with a great deal of interest, being acquainted with the measurement of base lines. We have made provision in Ottawa for doing similar work. We have now our bar, with which the measures will be tested. I haven't seen the work of this description carried out on a large scale, but it is certainly fairly simple. You have to know the record of your tension. It is an essential thing in determining the length of your line in using the Invar tape. This name may not be familiar to you, but it applies to a new material that is used and is derived from "invariable" because the co-efficient of expansion is so small. These tapes are now used in the United States Coast Survey. I was recently in Washington, at the Bureau of Standards, where they tested them before they went out and tested them after they came in. Two were used and two were not used, so that when they returned they were tested to see their variability of length, and it was found that those which had been used were in better shape. The difference was actually smaller than the two tapes that had been left in the office, and weren't used at all, but in either case it is a very small quantity.

As Prof. Stewart has said, for years the great trouble has been the question of temperature in the determination of base lines when using tapes. You couldn't tell what the temperature was. You would have the thermometer and you would assume that the temperature of your tape was the same as your thermometer showed, whereas there was no assurance that was the case, and actual experience has shown that it wasn't the case.

I have seen the experiments that were made along the 98th meridian. The little piece of copper on which the record is made is about half an inch in width, and it is nailed to a piece of scantling and this is driven into the ground and a mark is cut on it for continuing your measurements. The measurements are made [illegible] night time. With [illegible] the [illegible] is very small, the temperature in the evening and at night is nearer than in the day time, and to secure closer measurements it is made at night. In the United States measurements they didn't take into consideration the catenary at all. The correction for this is very small. The tapes are supported on nails driven into the sides of the scantling, so the curve is very slight. They don't take any time, because the measurement is made at a uniform tension of thirty pounds. The man has a [illegible] in his hand, and it is attached to the spring balance and the moment he gets it steady at 30 he says "Mark!" and the tape is marked. In Prof. Stewart's method you understand the tape is pulled out but without reference to what the particular tension is. He gets at the tension by getting at the ordinate base. These are the points of difference between the United States method and Prof. Stewart's suggestion. He doesn't need to bother about the tension, because he had the tension from the ordinate. The method is good, but whether it would work out in the field more economically than the other I am not prepared to say.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

MUNICIPAL FOREST RESERVES.

By Thos. Southworth.

The experience of centuries and in many countries has demonstrated that for climatic reasons, protection of water supply and permanent supplies of timber, not less than 20 per cent. of the land area of a country should be maintained under forest cover.

In a country such as Ontario, where there is much broken land, this condition can be secured while keeping the purely arable land for the growing of general farm crops. Owing to the broken and undulating character of Southern Ontario, there is probably 20 per cent. of the total area that could be more profitably used for growing trees than for any other purpose. It so happens, however, that all this land is now in the hands of private individuals. In some countries not quite so democratic as ours, the State has intervened and taken control in the public interest of property held by private individuals. In some European countries in particular the State defines how much of the land on certain estates must be kept in forests and what proportion of it may be used for other crops. I am afraid, however, that with us this so-called interference with the liberty of the subject would receive a great deal of opposition, and be difficult of enforcement, at least for some time to come.

Therefore we are dependent at present upon the efforts of the individual land owners in Southern Ontario to maintain the proper proportion of forested to cleared land. Investigations made by the Bureau of Forestry from time to time, using the assessment returns of the farm lands in the different counties, has shown that individual ownership of the land has left us with very much less forested area than the safety of the community demands. Instead of there being 20 or 25 per cent. of the total area in forests, in some whole counties the percentage does not exceed seven or eight per cent. in forests, and in some townships the percentage is much below that.

The necessary result of this intensive clearing is shown in

these counties by the depleted water supply, the rapid evaporation from the soil causing occasional droughts in summer when rains are not as frequent as usual, and quite often disastrous floods in the spring caused by the rapid run-off of the water on an open country.

The Department of Agriculture is making a determined effort to change this condition of affairs by supplying seedling trees to farmers for the purpose of increasing their woodland area. This is likely to be a slow process, however, and it will be many years, even assuming that the farmers take advantage in large numbers of the offer of the Department to supply them with plant material, before anything like a proper proportion of forest is secured in the denuded lands of Southern Ontario.

The individual effort of landholders cannot, I am afraid, be depended upon to bring back the proper condition of affairs in this respect. Where a farmer has a good sized wood lot in good condition, a temporary financial stringency (owing, perhaps, to the failure of some other crops) may induce him to clear off his wood lot for the cash that would be received from the timber, and he can scarcely be blamed for pursuing a course that appears to him to be in his individual interests, although it might not be for the general interest of the community.

Combined or communistic action only can be depended upon to bring about the proper condition. In 1903 I officially brought to the attention of the public in the Forestry Report for that year, the advisability of taking action of this sort through legislation, looking to the creation of municipal or communal forest reserves.

Legislation not supported by public opinion is likely to be inoperative or non-effective. As a matter of fact, it is hard to conceive of legislation for which there has been no public demand. The various land surveyors distributed throughout the Province doing local work are usually important members of the community in which they work. They have, or should have, a very important influence on public matters in their respective communities, and can do much towards shaping public opinion in matters of this sort. For that reason I desire to present to this Association some advantages that appear to me would accrue to the general community from the establishment of forest reserves owned by the various municipalities, not only in the southern or older settled parts of the Province, but in Muskoka, Parry Sound, Haliburton, and in the newer communities now being opened for settlement.

It is, therefore, safe to assume that dependence cannot be placed upon the individual owners of farm lands in Ontario to provide for the proper proportion of woodland, and if provision

is made for this it must be done by the people as a whole, and not by individuals.

The presence of an immense area of forested lands in our north country in one block would not accomplish the object aimed at. Forests, to be effective in the protection of climate, etc., would need to be present also in the southern part of the Province, and it would be far better for the general interests of a community both for climatic reasons, water supply, and for local supplies of timber and fuel, that the forested areas should be scattered in the different counties, and even different townships, throughout the Province.

Forests, to be worked perpetually, can, of course, be managed much more economically where they occur in solid blocks of large size, but as the idea of municipal forest reserves would be not alone for the direct commercial advantage derived from their growth and exploitation, but would include also the incidental advantages of water protection, etc., the question of the most economical management could be to some extent ignored. A comparatively small area of say, 500 or 1,000 acres, even if divided into smaller lots scattered through a township under a proper management could be made productive of a very good revenue; indeed, many communal forests in Saxony and elsewhere produce a net yearly profit of $4.50 per acre, and in some few cases a sum considerably in excess of that.

At the present rate of destruction to which the woods in Southern Ontario are subject, the local demand for timber and fuel throughout that territory would enable small forested tracts of this sort to yield a revenue equal to or in excess of that mentioned. The Province might, of course, acquire tracts of land scattered throughout the country for the purpose of permanent forests, but unless the Province held them subject to local taxation, which in many cases might be excessive, it would scarcely be fair to the municipality to withdraw this land from the assessed area of the township without making some compensation to the municipality in lieu of taxes that would be levied upon the land were it left in private hands. Hence, it would seem to be better that these small forest reserves should be held by the township municipalities.

At present there is no provision in our Statutes that would permit municipalities to hold land for this purpose. Municipalities, particularly in Parry Sound, Muskoka, Haliburton and elsewhere, frequently acquire land for arrears of taxes. This land, however, can only be held by the municipality for a term of years, when it must be put up at auction and re-sold. It is proposed, therefore, that the Municipal Act should be amended so as

to permit the holding of land in perpetuity by the municipalities when held for the particular purpose of producing timber.

It should not be in the power of a municipality to convert this land to other purposes. Neither would it be wise to leave the management of these reserves to the municipality, with their lack of continuity in government. Some municipal councils might manage them successfully and wisely; others, on the other hand, might insist on cutting off all the timber before it reached its most profitable age, in order to promote a low tax rate. Hence, I think it would be advisable in the case of reserves of this sort that the management of them should be vested in the Bureau of Forestry, under the direction of the Minister of Agriculture.

In many settled townships a sufficient area of land could be acquired through delinquent taxes. In others, however, it might be necessary to purchase land for the purpose. The land to be acquired by arrears of taxes or by purchase would naturally be the least productive or least valuable land in the township, land that could be made much more valuable if placed under forest and properly managed.

In the case of the purchase of land for this purpose, it would probably require some years after purchase before it would be revenue producing, and in the case of many townships they would find it burdensome to raise the money necessary to acquire such land. It might, therefore, be advisable for the Province to provide a general fund that might be drawn upon for the purchase of land by municipalities for forest purposes, to be repaid to the Province from the revenues of the forest reserves.

A very large area of the Province has recently been surveyed and opened for settlement, and a much more extensive area has yet to be surveyed and settled. There are very few of these townships which do not contain some proportion of the land that is not well suited for general agriculture. In these the Crown might very well retain such lands as are not suited for this purpose as forest reserves, to be turned over to the municipality when properly organized.

The legislation that would seem to be in order, therefore, would be largely along the following lines, that is to say, the Municipal Reserves Act should include provisions somewhat as follows:

That municipalities be permitted to hold in perpetuity for forest purposes such lands as are forfeited to the municipality for non-payment of taxes;

That municipalities be permitted to accept in gift and to purchase lands for municipal forest reserves;

That municipalities may secure loans on the credit of the Province for the purpose of purchasing lands for forest purposes, subject to the approval of the Bureau of Forestry. This latter provision might also include a condition that the municipality should raise an equal amount to that borrowed from the Province;

It should also provide for the examination of new townships before they are opened for location and settlement, and a reservation made of suitable areas of such lands as are found to be unsuited for general agriculture for the purpose of municipal reserves, to be held by the Crown until the organization of the municipality, when they can be vested in the latter;

To provide for the placing of all lands acquired or held by municipalities for forest reserve purposes under the management of the Bureau of Forestry, under the direction of the Minister of Agriculture;

The Act to further provide that the surplus revenues of these reserves, after deducting the cost of management, should be returned to the municipal treasury and to the extinguishment of the debt contracted in their acquirement.

A great deal has been said from time to time regarding the destructive methods of Canadian lumbering and the disappearance of Ontario forests on this account. While much of this is true, it is not true that the destruction of the forests by lumbermen has caused the deforestation that is dangerous to our water supplies and to our climate. Even if a forest is lumbered very excessively and subsequently burned, the area is almost immediately covered with a new growth of trees of some sort, which affords the necessary soil cover to permit the slow run-off of water and check the rapid evaporation from the soil. It is when the land is given to the individual settler, and he in clearing the land to provide for the growth of cereals and other crops extends his clearing beyond the limit of public safety; and it is this particular danger that it seems to me can best be removed by the establishment of municipal reserves as suggested.

That it would be profitable to the municipality I have no doubt whatever. In any ordinary township 5,000 acres would be a small or reasonable area for forest. Very few townships but contain much more than that area of broken, rough and hilly land that would be suitable for reserves. This land, being at present not very productive, is under a low assessment, and produces little either to the present owner or to the township treasury. Under forest, properly managed, $3.00 or even $4.00 is not an unreasonable estimate for the annual yield per acre in Southern Ontario, where timber supplies have already become scarce and high priced.

$10,000 or $20,000 per year revenue from forested lands owned by the township would go a long way towards providing the funds required for municipal and school taxes, and thus relieving the individual taxpayers to that extent.

DISCUSSION.

Mr. H. J. Bowman—We are all more or less familiar with the evil effects of removing the forests. In the western part of Ontario we feel this particularly. In the valley of the Grand River, with which the Chairman is familiar, the re-foresting of the Grand River Valley was the subject of a paper by Mr. W. H. Ridout, read before the Society of Civil Engineers, and it was indeed a very interesting paper. At the present time the run of the water is so rapid in the spring as to wear away the banks and the bridges, and I think Mr. Ridout's suggestion that there should be storage reservoirs to regulate that, and also the principle of re-foresting some of the upper districts at the sources of supply, was a good one. I am sure it is a very serious matter all over the older parts of Ontario, especially from the farmer's standpoint. That, I suppose, is Mr. Southworth's problem, and we, as surveyors, can only wish him God speed in the work. I don't know that we can help him very much, except to disseminate his views, and we will be glad to do so in our different districts.

Mr. Southworth—You can't depend on the farmer to do it. It isn't business for him to do it. If he has 160 acres of wheat land he is going to grow wheat, but it is in the interests of the general community that there should be a general percentage of that land put in forests. But we can't depend on the farmer, and I don't know of any way we can make him do it. The only way I can see is for the municipality to acquire land and grow forests. Forest crops take a long time to mature, and it is only municipalities which are continuous and have no lifetime that can afford to do it; and it is with the idea of getting this question of the main forested areas in the Township held by the people as a whole that my paper is directed to this Association, and I would like to hear from some of the members what they think of the feasibility of the plan.

The President—It occurred to me that the question was more a matter for the Province than the individual municipality. I am thinking of what they have been doing in the United States, because a municipality, you may say, may be doing a great deal of work that they don't get any benefit from. It is the people who are living below us who are getting the benefit, and why should we

have forest reserves to benefit them? So it seems to me it is a wider field than of the individual municipality, and the question arises whether it is not the function of the Provincial Government. It should emanate from them. The protecton of the water supply, of course, is a question that admits of discussion. I know in the Western States, where their water supply is very limited, in the State of Kansas or Nebraska, they were taking water from the LaPlatte River, and the people below were complaining of their taking this water, and the Federal Government had to step in and take hold of the question. It was thought to be wider than the individual States. This is a question that is worthy of discussion, to find how the greatest good can be done to the greatest number, whether by the Provincial Government or the Municipal Government.

Mr. Southworth—If the Province undertook to establish Municipal Reserves, scattered all over the Province, it would practically mean the withdrawing of that amount of land from municipal taxation, because land held by the central Government is not taxable, and they have to compensate the municipalities for the land as regards taxes. Now, my suggestion was this—the Reserves should be held by the municipalities, but they should be managed and under the control of the central Government, in order to have a systematic management and to prevent too hasty sale, but all the revenue over and above the cost of management should go to the individual municipality in which the Reserves were located. That seems to me to be a scheme that would meet the approval of the people, rather than for the Government to assume the total management of it. It would be necessary to have it under Government control in order to get continuity of management, but the revenue should go to the municipalities in lieu of the taxes they would otherwise get from these lands.

Mr. Bowman—In reference to the question of taxation, I remember that there was a bill before the House a short time ago to exempt wood lands from taxation, and it seemed to me that was a very good idea. I would like to hear from Mr. Southworth about that.

Mr. Southworth—The bill passed.

Mr. Bowman—Does that mean that the farmers are not taxed for their bush?

Mr. Southworth—No, it doesn't, unfortunately.

Mr. Bowman—In some parts of Western Ontario the area of wood is very low, and even that which is left is going. It would be a good idea if the Government could exempt the wood lands from taxation.

Mr. Southworth—The bill introduced by Mr. Downey and passed by the House was a permissive bill, and I don't know that any advantage has been taken of it in the Province. It remains in the individual to put the bill into effect, and it is rather educative than legislative.

The President—It is left to the municipality to accept the bill and to see that all wood lands will be exempt?

Mr. Southworth—Yes, up to a certain extent.

The President—It is an encouragement to preserve the forests.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

"THE SURVEYOR AND EARTHQUAKES."

BY OTTO J. KLOTZ, OTTAWA.

I will say at the outset that I am unable, for lack of data, to do justice to the title which I have chosen for my paper.

Destructive and calamitous as has been the San Francisco earthquake, yet from a scientific standpoint it has given a decided impetus to the study of seismology, and it has hastened the day when our knowledge of the interior of the earth will be of a definite character, which it is not now, if we except the comparatively few feet that we have penetrated into the earth. Nature is an aggregaton of facts, and it is the sphere of the investigator to correlate these facts and to explain their existence. In the effort to solve the latter, advancement is generally gained by the method of elimination. As facts do not generally admit of mathematical analysis, theories and hypotheses are advanced for their explanation. These temporary fortresses must then be able to resist the relentless cannon of observation and criticism, for the enemy gives absolutely no quarter. Error succumbs to the first broadside, plausibility turns away many a shock, and can stand a long siege. It serves a good purpose in permitting the enemy to reinforce its resources to keep up the attack until either the fortress is razed or a new one has been built within, built with the impenetrable nickel-steel armor of truth.

Perhaps a brief review of some of the reasons assigned as the cause of earthquakes, leaving out those of supernatural origin, may not be unprofitable.

We know that there are many sedimentary deposits or formations constituting part of the crust of the earth. We know that they are more or less soluble. We know that the immediate crust of the earth is intersected and traversed by subterranean watercourses. We know that these watercourses, when brought to the surface, are charged more or less with salts, such as of lime or sodium, dissolved from the formations through which the waters passed. Now let us put two and two together. If a subterranean stream discharges n cubic feet of water per day, and each cubic foot contains p grains of lime, how long will it take to carry away

[illegible] cubic miles of limestone rock? The result of our investigation is a hole in the ground, or rather, a hole in the earth, and if we make that hole big enough, something is going to fall—the roof is going to collapse and we have an earthquake. This, in brief, is the Dynamic or down throw theory. Now some earthquakes have happened which might be explained by the above, but [illegible] the lower number other reasons must be sought. Before discussing the above it may be suggested that, although subterranean waters must and do hollow out the earth's crust, the formations [illegible] adjust themselves to the [illegible] continuously [illegible] large cavities [illegible] about [illegible] This [illegible] quite [illegible] Ja- [illegible] that [illegible] earth's [illegible]

[illegible]

equilibrium, strains and stresses are set up and a counter tendency to relieve these strains and stresses is called forth to restore equilibrium. It is at this juncture that the property of the tetrahedron comes into play. Taking as the principal disturbing force of our supposed liquid or molton spheroid of revolution, that of dissipation of heat or cooling process, we find that the crust or shell of the earth tries to adjust itself to the strains set up by the contracting body, and does so by the line of least resistance, that is, by spreading the strains over the greatest surface, with the result that the tendency of the surface of the earth is to assume the tetrahedral form, i.e., of an equilateral pyramid, or, one might say that the contracting earth changes into that form whereby the original superficial area is maintained. For equal surfaces, the volumes of the sphere and tetrahedron are to each other as 1:.55, and for equal volumes the surfaces are as 1:1,449.

Neither the theory nor its advocates gives us a four-cornered earth, its original condition and axial revolution would prevent that, but the theory does claim that the tendency, however slight or great in effect, must be towards shaping the surface into that of a tetrahedron or tetrahedroid, the latter having curved surfaces or edges. If a complete transformation from the sphere to the tetrahedron took place, which is, of course, impossible, we would have—taking the axis of the earth coincident with an axis of the tetrahedron through one of its apices—a north polar sea, which is the case; three great equatorial oceans; a south polar land cap, which too is the case; and there would be six grand mountain ranges, three diverging from the south pole, corresponding to three edges of the tetrahedron, and the other three encircling the northern hemisphere, being along the remaining three edges of the pyramid.

In the tetrahedron every corner has a surface opposite to it, so that for the earth this would mean that land and water are antipodal, which is fairly well represented in the actual conditions. Another result would be that land masses would be broad in the northern hemisphere, and taper towards the south, which, too, agrees with our geography. Inversely, the oceans should contract towards the north, a condition fairly well borne out. Furthermore, the north polar area being represented by a surface and the south polar one by a corner, it would follow that the flattening of the earth in the southern hemisphere would be less than in the northern; and again, gravity would increase less rapidly towards the south pole than towards the north pole. Both these considerations have been confirmed by geodetic and pendulum observations.

If the tetrahedral theory was effective at the early stage of

the earth's existence, in giving us many of our mountain systems and our polar physical conditions, to-day with a pretty rigid crust its effects must be vanishingly small and unrecognizable as due to that theory.

We may refer to another theory of the figure of earth, contained in a paper presented by J. H. Jeans to the Royal Society in 1902. This theory shows, under certain assumption, that the earth was pear shaped at a certain stage of its existence and contracting assumed the spherical form. I cannot in this place pursue this subject of the figure of the earth any further—it was only alluded to to show one of the factors—the contracting forces, ever active, whereby strains and stresses are set up, and without which no earthquakes are possible. Fisher, in his "Physics of the Earth's Crust," 1889, combats the theory of mountain building as being due to the secular cooling of the earth and the accompanying contractions, but this would not preclude smaller motions to which earthquakes may be relegated.

Arrhenius considers the crust of the earth comparatively thin, at a depth of about 40 miles to merge into a hot fluid mass, the magma, due to the increasing temperature. From the deepest boring on the earth, the increase of temperature is about one degree F. for 51 feet, or say 100 degrees F. per mile. Beyond a depth of about 200 miles the magma assumes the gaseous form. He writes: "The earth, as well as the sun, contracts, whereby heat is evolved and the contraction partly arrested or decreased. Nevertheless the earth slowly shrinks—this pertains especially to the interior of the earth—for the temperature of the surface is almost wholly due to radiation from the sun, and in a small degree upon the character of the atmosphere. It may be assumed that, broadly speaking, the radiation of the sun and the nature of the atmosphere are constant. It follows, therefore, that the crust of the earth will not follow the shrinking of the interior. Folding and wrinkles will be found, and it is the general conclusion that this is the principal reason for the uplift of the surface into mountain chains." The "general conclusion" must be taken with some reserve.

That earthquakes are due to an adjustment of stresses in the earth's crust is admitted by all investigators, but on the cause of the stresses there is far from unanimity of opinion.

Although some earthquakes are due to down-falls, and local ones to volcanic eruptions, yet for the great majority another reason or reasons must be found. Of the latter, the contracting force, already alluded to, is the one first to suggest itself, and has for its support at least great plausibility. It has been combated

by able investigators, without, however, being able wholly or satisfactorily to dispose of it completely.

Leaving out of consideration the earth as a cooling and contracting body, let us picture to ourselves the earth at any time in a state of perfect equilibrium, there being no stresses on its surface nor in the crust. Let us note the physical features, the height of the mountains, the faulting and folding of the rock formation, the depths of the ocean and the distribution of land and water. Now let the atmospheric influences come into play—rain and snow, heat and cold, together with varying atmospheric pressure. The pre-existing equilibrium will be immediately disturbed; the water, as ripples, creeks, rivers and streams, will begin its work of erosion and denudation; heat and frost will assist in the disintegration of mountain masses, and the ocean beds adjoining the continents will be loaded by enormous amounts of detritus carried from the land. Unless there is a continuous and simultaneous adjustment of the change of pressure, the strains set up will be cumulative and continue so until they exceed the limit of elasticity, when rupture must take place to restore equilibrium for the time being. Rupture would necessarily be accompanied by earthquakes. It is obvious, therefore, that meteoric or atmospheric influences are capable of setting up strains on the earth's surface. It is safe to say that the whole surface of the earth is in a constant tremor due to stresses. But besides the general condition, there are other factors that come into play, and localize in a measure the seismic disturbance. These are mountain masses and oceanic depths, especially if they are contiguous. Speaking generally, mountains are not masses resting upon the surface of the earth, but must be considered as masses immersed in the earth, just as an iceberg is immersed in the water. The greater the part that projects above the water, the greater must be the part beneath the surface, for the amount of water displaced must be equal to the floating mass, otherwise there would not be equilibrium. Somewhat similar it is with the mountains; were they resting on the surface, the strains set up by the superimposed mass would not only be enormous, but would be greater than the crust could support. Furthermore, as a superimposed mass, it would materially affect the force of gravity in the adjoining region. The most noted investigation of this question was with reference to the attraction of the Himalayas in connection with the great trigonometrical survey of India. Pendulum observations have shown conclusively both in India and America that this is not the case. However, complete equilibrium or isostasy does not obtain, and hence the residual strains and stresses.

It is obvious how through meteoric agencies cycles of changes are produced. The mountains by movements are wandering sea-

ward; the continents are lightening, and the ocean bed is being loaded, producing a deep-seated inflow from the sea towards the land. These changes are continuously taking place; the earth's crust and surface are undergoing constant transformation, however minute; the strains and stresses are continually responding to one another; vast rock formations that seem rigid are by the slow process of time bent and contorted as if made of wire. But when these responses are not synchronous when there is a lag, equilibrium can only be restored by rupture. This rupture will be along the line of least resistance, and this is generally found in a geological fault, an old rent in the crust, so well illustrated in the California earthquake of last April.

If the earth were a homogenous body, or if at least it were composed of concentric shells, each of homogenous matter, then the geodetic surveyor, when carrying on large trigonometric surveys would not be troubled with closing errors, other than those arising from observation. There would be no error due to deflection of the plumb line. As complete isostasy does not, however, exist, those observed discordances, due to the unsymmetrical distribution of matter, are a measure of isostasy.

Dr. J. F. Hayford has examined the data furnished by the triangulations of the United States by the coast and geodetic survey, and has found 71 miles as the most probable value for the depth of compensation, that is, the depth at which the compensation of the excess of matter at the surface (continents) by defect of density below, and of surface defect of matter (oceans) by excess of matter below is complete. At and below this depth the conditions as to stress of any element of mass is isostatic, that is, any element of mass is subject to equal pressure from all directions, as if it were a portion of a perfect fluid. From this it appears that the behaviour of the magma (state) beyond 71 miles, is that of a fluid.

As earthquakes are so [illegible] matter bound up with stresses, we cannot [illegible] with terms of stresses. It is safe to say that these geodetic observations prove that the actual stresses in and about the United States have been so reduced by isostatic adjustment that they are less than, perhaps, as great as they would be if the continent were not raised in its elevated position, and the ocean bed not depressed in its depressed position by the rigidity of the earth. It is certain that for the United States and adjacent regions including oceans, the isostatic compensation is more than two-thirds complete, perhaps much more. The [illegible] result is one of the most brilliant mechanical deductions in geodesy and geophysics in [illegible] years.

Several issues have been addressed, which continue or may

contribute to the production of earthquakes. In investigations, one is sometimes led to the discovery of widely different phenomena, which, however, synchronize with each other, thereby raising the question whether one is dependent upon the other or whether the coincidence is fortuitous or whether both phenomena depend on a common cause. Such a case is the possibility of a connection between latitude variations and earthquakes. On this point Professor Omori, one of the foremost of seismologists, says, "From an examination of the mean monthly values of the latitude of Tokio I have found that all the destructive earthquakes of recent years in Japan have occurred exactly, or very nearly, when the latitude was at a maximum or minimum." Verily, our solid earth is only so in a Pickwickian sense, the surface slides bodily over the figure of revolution, our excursions in latitudes being about 26 feet, not enough to get lost when away from camp, but enough to get lost in trying to find an explanation. Then there are the earthquakes that play skittles with everything and anything on the surface, as we shall presently see.

You may be inclined to ask, after so much talk about the earth and earthquakes, where does the surveyor come in? Well, the functions of the surveyor with reference to earthquakes are twofold. In the first place, the scientific work of determining by re-occupying stations of a triangulation net in the disturbed area, the amount of displacement at each station, and in the next place the re-tracing of old lines, division lines of property, in the shaken district. With reference to the latter, I can only allude to the facts of the displacement of proprietary boundaries, and leave to each of you your own device of how such lines should be re-run. It would put, I think, to a severe strain our otherwise so lucid Survey Act, to find the particular section to apply to such a case. When the "governing line" is pushed over into the next township, what are you going to do about it? Will you join the front and rear original posts of a lot, and thereby put perhaps a house onto the neighbor's property? Many such questions present themselves in Japan, in Peru, in Chile, and to some degree in California, by the recent quake.

Imagine a giant to grab a section of country and give a mighty pull, stretching the country perhaps half a chain, while beside him stood another giant, who gave a herculean push, jamming the earth together. The shearing plane would become the rift or fissure or geological fault. After this performance, look at the line fences, posts and monuments, and say what you are going to do about it? I confess it is easier to propose these questions than to answer them.

With your permission, I shall give a few extracts from orig-

[illegible]

but for eight entire days put on a sulphurous one and kept it constantly; for, from the bowels of the earth, agitated in their nethermost depth and poured into it, and from sulphurous mines, its waters were diluted with an abundance of liquid sulphur." The earthquake lasted with ever increasing intervals until the following September.

I should not be surprised that if we had accurate measures of the relative positions prior to 1663, of points on the two sides of the river, it would have been subsequently found that there was a displacement, as it is fairly certain that the movement was relative to the channel as indicated above. As far as I can gather, the surveyor or arpenteur didn't make any money out of this land "excitement."

Coming to the earthquake at Port Royal, Jamaica, on June 7, 1692, the Anglican minister there writes the following week (15th June), "Captain Ruden's house, upon the first concussion, sank into the earth and then into the sea, with his wife and family and some who were come to dine with him. I saw the earth open and swallow up a multitude of people, and the sea mounting in upon us over the fortifications. The earth working all the while with new motions and tremblings like the rowlings of the sea. I found the sea had entirely swallowed up the wharf, with all the goodly brick houses upon it, most of them as fine as those in Cheapside, and two entire streets beyond that. In the space of three minutes, about half an hour after eleven in the morning, Port Royal was shaken and shattered to pieces, sunk into and covered, for the greater part, by the sea, and will in a short time be wholly eaten up by it. We guess that by the falling of the houses, opening of the earth and inundations of the waters, there are lost 1,500 persons. Our great and famous burial place was destroyed by the earthquake, which, dashing to pieces the tombs whereof there were hundreds in that place, the sea washed the carcasses of those who had been buried, out of their graves. From St. Anne's we hear of 1,000 acres of wood land changed into the sea, and carrying with it whole plantations. Whole streets (with inhabitants) were swallowed up by the opening earth, which then shutting upon them, squeezed the people to death. And in that manner several are left buried with their heads above ground, only some heads the dogs have eaten, others are covered with dust and earth, by the people who yet remain in the place, to avoid the stench. The two great mountains at the entrance into 16-mile walk fell, and meeting, stopped the river. At Yellows a great mountain split, and falling into the level land, covered several settlements. One person had his plantation removed half a mile from the place where it formerly stood, and now good provisions grow upon it."

Of the same earthquake. Dr. Morley "Takes notice that he had felt several lesser shakes, and heard the noise often, which is very loud, and by those not used to hear it, it may be easily taken for a rustling wind or hollow, rumbling thunder; but he says it hath some puffing blasts peculiar to itself, most like those of a brimstone match when lighted, but in a much greater degree, and such as a large magazine of brimstone may be suffered to make when on fire. He adds, that in Port Royal and many places all over the island, much sulphurous, combustible matter had been found, supposed to have been thrown out, upon the opening of the earth, which upon the first touch of fire would flame and burn like a candle." In this earthquake at Port Royal the shore line subsided 26 to 48 feet beneath the sea.

In the same year, 1692, possibly synchronizing with the preceding Jamaican quake, was the severe one at Riobamba in the Province of Quito. "It shook the earth in such a manner that it tore off great pieces, which were seen to run entire three or four leagues from the place where they had been before, and thus to remove whole fields, with the trees and houses standing. This event occasioned the most extraordinary lawsuits that were ever heard of, brought to Lima, to decide to whom these estates belonged, the party on one side alleging that they were within his jurisdiction or lordship, and the other pleading that he was upon his own land." This is the most pointed reference to lawsuits resulting from earthquakes that I have come across. I think we must take the sliding about of the country nine to twelve miles with a grain of salt. Imagine Toronto waking up some fine morning and finding itself on the other side of Mimico. What a harvest the surveyors would reap. Professors Galbraith and Stewart would not be able to supply the demand for surveyors.

Coming now to the great earthquake of October 28th, 1746, in Lima, I shall quote a few sentences from the volume of the following year describing the catastrophe. "But it is most certain that the two main principles of these dreadful mischiefs are heat and moisture. However, supposing such to be the case, it does not at all hinder, but that the Almighty Power may employ these natural accidents as the instrument of punishment to a wicked people. There was not before the late calamity a more licentious spot upon the earth. The charming serenity of the climate and fruitfulness of the country, the plenty of all things, and the sedate tranquility which the Spaniards perpetually enjoyed, these, together with the extreme beauty of the women, did not a little contribute to an amorous disposition, which was the prevailing passion of the inhabitants." . . . . .

"Lima being subject, with very little intermissions, to such

dreadful calamities, one would imagine it was the habitation only of criminals sent thither for punishment, or of the people who were weary of life, and not of such as made it their choice to live there. But so powerful are the allurements of riches, so bewitching the hope of gain, as to make danger preferable to safety, and the continual fear of death reconcilable with the desire of living long and out of harm's way. Of all judgments, proceeding from the natural causes, which the Deity often inflicts on offenders, in order to satisfy divine justice and manifest His almighty power, the unexpected stroke of sudden earthquake hath ever been the most tremendous, forasmuch as in one and the same moment they become both the warnings and executioners of its wrath. This fatal catastrophe befell the place thirty minutes after ten at night, when the sun was in 5° 10′ of Scorpio, and the moon in not much less of Taurus, so that these planets wanted very little of being in opposition, as they actually were five hours and twenty-two minutes afterwards, an aspect which by constant observation hath proved unfortunate in this climate; for under its influence these convulsive kinds of agitations in the earth do most usually happen. On this occasion the destruction did not so much as give time for fright, for at one and the same instant almost, the noise, the shock, and the ruins were perceived together, so that in the space of only four minutes, during which the greatest force of the earthquake lasted, some found themselves buried under the ruins of the falling houses, and others were crushed to death in the street by the tumbling of the walls, which as they ran here and there, fell upon them. The earth struck against the edifices with such violent percussions that every shock beat down the greater part of them." Of a total of about 3,000 houses within the city walls, scarce 20 were left standing, and of the estimated population of 60,000, only 1,141 were killed. The small loss of life is due largely to the one-storey buildings. The seaport of Lima, Callao, with a population of 5,000, was wholly destroyed by a tidal wave accompanying the earthquake, only about 200 escaped. Ships were thrown high and dry over Callao.

In reading the descriptions of these old earthquakes, we cannot but perceive a certain mental attitude of the people towards the phenomenon, and that attitiude may best, perhaps, be expressed by saying with Shakespeare, "Conscience does make cowards of us all."

Coming to more recent times, and quoting such sections as refer to displacements, we find for the New Madrid earthquake of 1811, along the middle Mississippi (Pop. Science Monthly, July, 1906), "In one instance a settler, living on a neck of land lying within a great bend or ox-bow, started at daybreak the morning after the quake to go to his well which the night before had been

on his land. But no well was there. Instead the river was at his door. Glancing across the water, however, the well could be seen on the further side. During the night a crack had been formed between the house and the well, and had been taken possession of by the waters, leaving both unharmed, though on opposite sides of the stream. In the Mississippi, whole islands disappeared. Some of the earthquake rents were of great size, having widths of thirty feet and more, while some are reported as many as five miles in [illegible] and were covered by water, one of them [illegible]

[illegible] miles, and [illegible] will be dealt [illegible] the legal subdivisions [illegible] N.W., S.E., in [illegible] miles. The [illegible] displacements of earth [illegible] shifting was [illegible] the south side. Although [illegible] was more [illegible]

Now the whole [illegible] consists of a network of triangles, so that while sections [illegible] on one side are some on another of the rift. Some [illegible] have been [illegible] since the earthquake for the purpose of finding the displacements by observing the angles between them and their adjacents.

The triangulation method, south of Ocean, near the northern [illegible] of the discovered [illegible] shows a displacement in latitude, based on the most reliable observations made, in the triangulation [illegible] the rift [illegible] about 10 miles, changes of [illegible] have been found, varying in the case, on the side of the small triangle, and that side nearly in the side of the rift, a change of [illegible] has been found, equivalent to about 16 [illegible] the rift. He sees the *relative* displacement of the sides, without being able, however, to [illegible] whether both moved. The [illegible] shows that both sides or areas moved, the [illegible] and at a decreasing rate [illegible] the rift.

The [illegible] although more [illegible] world-shaking [illegible] the California [illegible] swing [illegible] the [illegible] twenty times greater for the [illegible] generally judged [illegible]

their destructiveness to man and his works. This depends on how near or close a city or habitation is to the rift where the greatest shaking takes place.

Earthquake instruments are, however, oblivious to man or his toy works, they record simply the working of mother earth, so that the great earthquakes of the seismologist are not necessarily coincident with the great earthquakes of man. So far I have seen no data with reference to the Kingston quake show any lateral displacement, simply the bald statement that "the bottom of the harbor has sunk many feet." Nor have I seen any reference to the rift, but from the destructiveness of the quake I infer that the rift must be very close to the city, very likely in the water, and hence not visible.

In the calamitous earthquake of Valparaiso last 16th of August, it is reported that the harbor is now ten feet shallower than before that event, and that the motion was mostly vertical.

The most noted vertical movement of recent years was the Alaska quake of September 16th, 1889, when the uplift along the Yakutat coast for upwards of 100 miles, was many feet, reaching its maximum in Disenchantment Bay, where the land rose 47 feet. Had there been any cities there, the propriety of the name of the bay would have been intensified.

The last quarter of a century stands out prominently as the most marked in seismic disturbances of which we have any historic record. It began with that cataclysmic explosion of Krakatao in 1883, noted for the red sunsets that followed for the next two years due to suspended dust in the upper regions of the atmosphere. Although there was no seismograph at Toronto at that time, in fact, none in America, yet that explosion was recorded in Toronto on the barometer, and most markedly. That titanic puff compressed the air and bounded back from the antipodal point of origin. This rebound was also recorded on the self-registering barometer. It was the biggest puff Toronto ever got. Time forbids me from enumerating the other notable quakes during the past twenty-five years.

I cannot tell you about the earthquake instruments; my paper has already grown beyond its original intent. I will simply say that one cannot but marvel at the sensitiveness of these instruments, which tell us of what is going on in the earth when our senses are wholly unable to detect the slightest disturbances or movement.

Whether the old earth heaves a sigh, in its long struggle against the inevitable when *rigor mortis* will set in, be it in Japan

or Italy, in Chile or Alaska, these silent observers that literally lay their ear to the ground, note the pulsations as they pass in their journey round the world. How gladly would the seismologist launch his little canoe on the seismic wave at the hypocentre, and just see whither and how fast the waves would carry him. There would be no harbor, no resting place; the course followed would be the one prescribed by nature, following the line of least resistance. The log of such a journey has yet to be written, and when it is written, we will know more about the crust of the earth, and the interior of the earth, than we do now.

In closing, you may ask, are we likely to have earthquakes in Canada? I would say in Eastern Canada we may, although the probability is rather remote, for the reason, in my view, that we have no great mountain heights nor any great ocean depths, and our great river is not a menace, from an earthquake point of view, as many other rivers, for instance the Mississippi. Our great River St. Lawrence has in its course a great chain of lakes, which form settlement basins, so that very little settlement enters the ocean. But if we were going to have an earthquake in Canada, and you were to ask me where it would likely be, I could answer you with considerable certainty that it would happen in the same place where the old earthquake happened in 1663, that is, along the line of the St. Lawrence River, and the city which would be the most affected if such a thing occurred would be the City of Quebec, because it lies along the greatest geological fault in Canada, which curves gently towards Lake Champlain. Gentlemen, I have given you a long talk, but I hope I have shown some connection between the earthquake and surveyors. (Applause).

Discussion.

Prof. Stewart—Mr. Chairman, when I first saw the title of the paper, I didn't see any very strong connection between the two, but I think the writer of the paper has shown very clearly how in earthquake countries that problems may be brought up of interest to surveyors. I think he has shown also how earthquakes are of very great interest to geologists and also to seismologists. About ten years ago, the time of the British Association meeting in Toronto, I listened with a great deal of pleasure to a lecture by Dr. Milne on the subject of earthquakes. He showed us a number of lantern views, and amongst others one I remember. It showed the effect of an earthquake in some part of Japan. It was a view of several acres, showing a town or city, with the buildings completely demolished, and in the midst of

this debris there stood one chimney stack, a portion of some ruined house or building. When he was on the spot he was so struck with this chimney stack remaining standing when everything else was flat on the ground, that he set to work to investigate the cause. I believe he arrived at the conclusion that the cause lay in the fact that the time of vibration of the chimney differed from that of the earth when it was quivering, and consequently it remained upright. On account of its perpendicular height it synchronized with the vibration of the earth, and consequently the effect of the earthquake was partially lost. I have never heard whether this principle could be made use of in designing buildings in earthquake countries, but it struck me at the time there was a possibility of that being the case. I believe that engineers in earthquake countries construct their buildings to resist as far as possible the shocks of earthquakes, and that is done by making the base of the building very strong and heavy and the other parts very light, but I have never heard of the principle which caused this chimney to stand, being made use of by a builder or architect.

The President—I might say, with regard to the instrument with which we record these shocks, it is a very simple instrument; the one we have at Ottawa is a horizontal pendulum resting against a vertical column on agate, and fine wires connecting it with the upper part, and it is movable horizontally. Now, the design of the instrument is that it should be steady and able to record what the earth is doing. Of course it is impossible to make it absolutely correct. We have a pendulum suspended so that when the earth is moving this thing would be recording exactly what the earth is doing, but of course our instrument must be connected with the earth in some way, so that the means devised is this, the pendulum is made fairly heavy and the bob is supposed to be a steady point. The pier is quite apart from our building, and sunk about three feet down into the earth, but quite independently of the building, and then we have this delicate instrument mounted on this pier. The pulsations come along and give the pier a shake, and the pendulum doesn't move. Relatively, it does move, but in reality it isn't supposed to move; but if the shocks continue for a long time, of course the pendulum will take up the shock; if the period of the pendulum happens to be the same as the pulsations, the pendulum begins to swing widely, and the recording is done. It is really the pier that moves and the pendulum remains behind, so to speak. There is at the end, where it rests against the upright stand, a little mirror, about the size of a ten-cent piece, and a beam of light about the size of a pin's head is reflected on to the hemispherical lens, and it is recorded on photographic paper. The paper is wound on a drum, and this drum revolves

once an hour, at the same time there is lateral movement, so that a record of the time is made. If there is no disturbance, this beam of light traces on the photographic paper a straight line. We have this light cut off every minute, so that we may know when anything happened. At the San Francisco earthquake the swing was very wide; it swung almost off the paper, and for the Kingston one, which was apparently more destructive as far as life was concerned, it was only about one-twentieth the displacement, so that you see the Kingston one was only a very small affair compared with the San Francisco one. Of course, the amount of destruction depends on whether the city is very close to the shock. If it is ten or fifteen miles away, the destruction will be smaller, so that it is the proximity that magnifies the earthquake as a phenomenon in the eyes of the public, which it doesn't do with us.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

THE RE-SURVEY OF LINES.

BY P. S. GIBSON.

I gave my name to Capt. Gamble, expecting to give a paper on the re-tracing of old lines, and I found it a very awkward thing to do. If you correct it up in one place it falls short in another, and I would have to go back to 12 Victoria. It would have taken me a very long time to look into this, and I have been very busy looking after some local improvements for the city. There was one particular road they wanted to extend from Toronto easterly, and I was working that up and preparing my plans, and it took some little work I can tell you.

I have a report and some sketches which I propose to speak on here, and you may look at them. It may help others on some local improvement work. Every surveyor should be thoroughly acquainted with that line of work. He must be prepared to explain to municipalities, and even to lawyers and solicitors of the corporations, and show these men what their duties are, and to be able to draw his plans and reports in such a way that there cannot be any failure. There are very few by-laws prepared in a sufficiently clear manner to be carried out. I know the by-laws of the County of York are in this condition. I have the by-law here, and then there is a by-law with reference to flankages—there appears to be a lot of them, because the lines are different. Some lines are triangles! This by-law with reference to the flankages declares how this shall be done. Now, our county adjoins the city, and the people outside want all the luxuries they have in the city; for instance, the sewage system. I was doing some work in connection with Heath street a while ago. Some lawyers who had built their houses out there would like to have a sewer put on that certain street, and the parties within the city limits said they wouldn't sign for it. They said, "If you want it, put it in and use it." The official engineers rather favored it and they got the petition signed. Well, they found it came a little too far, because the land drops towards Yonge street, and so the lawyer says, "We are up the height of land and it can go to the Oriole sewer," and I found a particular man's cellar would not be taken in at all. Every town

or village has a right to pass a petition to have it widened they can [illegible] work, but as a rule the Township issues upon having a petition come in. In requiring the petition we ask them if it shall stop streets and whether it shall be assessed per foot on the frontage or the frontage. In the past it has generally been referred back to us how they want it assessed.

Now sometimes some [illegible] have a number of lots. Take Dorman Street east for instance. When that was laid out it cost a lot of money getting the lines there and the improvements afterwards and when the street came the people said "You can have the lots." Now it was a case like under consideration. I said to the Council, "Don't let us have another village." But I said to the Board, "Give the Township council a free to the city right away before the Council decides in this matter." They put in their petition and I made my report but I held it back until we were assured the deeds would be signed, and finally I sent in my report. Now, in this that you will see the work. If you propose to do local improvements on a street and there are roads running north and south from it and [illegible] on it they sometimes say, "We are not going to pay taxes on this road," and the result is it is thrown on the Council. In Toronto the understanding is that they pay about one-third generally of the cost but the Township says, "We are not particularly interested. If you want a road round to those lots [illegible] what we think." That is what was proposed in this case. When [illegible] these various values, these lots I mentioned, a supplementary report and this is the report and the plan.

Now then a little more as to this procedure. As soon as this report is handed in it is [illegible] to the Council, to the Clerk and the Assessor and the Engineer and Solicitor and Treasurer. The first thing the Clerk takes it to see if it is sufficiently signed. That is by the majority as to [illegible] of the value. It is gone carefully into because I have [illegible] say it that you might be landed. He goes through them carefully with the assessor, and then the petition goes on to the Engineer to be examined. Then the Engineer takes the matter up and examines the quality if it is for sidewalks or opening up a street. He examines into it and takes a look and sees what [illegible] are required, if there are sewers and [illegible] and a preliminary report is made. Now, I've [illegible] all right when we had into it as to sanitary [illegible] and so on we report favorably. That is the [illegible] that is submitted to the Council but they don't hold meetings [illegible]. The result is we prepare our first report and we have [illegible] report ready, so the first report and the second report are actually in the same

day and they go through the Council. After the first report is put in, which is a formal affair, the by-law provides that the Engineer, after having gone carefully into the circumstances, shall make a report as to the property immediately benefited; that is, the property that will be assessed either in frontage or acreage assessment. I knew a case on Pape avenue where this happened, and the city assessed a man for I don't know how many thousand dollars, and then he appealed and lost, and the result was he was loaded up with costs more than his property was worth. He had a couple of lots fronting on Pape avenue, so he said, "You can have the lots now," and it wasn't clear the city could take anything more. So that the Council has to make sure of the matter, how it is to be done, by acreage or frontage. We investigated that, and in this case I prepared a plan showing all the lots fronting on this one street on the north and south. The plan is prepared then and the statement is made as to the lots. There are no flankages taken off. If there are flankages we make an allowance, and then I specify each one and I refer to this plan as being part of my report, so that the Clerk or the Solicitor can look at it and make up the whole thing. Then after certifying to these things, I have to state the total frontage, and the frontage they exempt from taxation. The Clerk then certifies to a certain thing and publishes it in the paper. You can get these plans at the Art Metropole if any of the members would like to get one. From this also he makes up the total frontage for assessment per foot frontage, and then the amount of land that is exempt. What I call the exemption in this case is the streets and where there are flankages making up a certain number of feet, and that assists the Clerk in making up his assessment. The next thing required under this by-law is as to the length of time—whether these improvements are permanent or only for a time. For instance, a sidewalk is limited to ten years and a sewer to twenty-five or thirty years, and a roadway like this is permanent. Then the next thing, it goes to the assessor. When the parties come to an agreement, which I explained before the Council, we take up this matter, because we have been caught on that. People have told us to go on and they would pay all the damage, and some would do it, and then some crank would say, "I won't pay that," and have an arbitration, and the cost would be more than the land was worth. So these estimates are prepared and we know what it costs. You cannot tell what the total cost will be of a local improvement until it is finished, but we give the approximate probable cost. I ask the parties before I begin, "How much money do you want to spend?" I can spend $10,000 or $5,000 or $3,000. If you put in an estimate and then the value exceeds ten per cent. more than you estimate, then it requires a second court revision, and the Clerk doesn't like that very well.

So in this case I said to the parties, "I want to know how much money you want spent," and they agreed about $4,000, so it was easy for me then to make up my report. We figured how much frontage there is, about $4 or $5 a foot, and they agreed on that. Then I stated the total cost would be about $8,000, and I may have $300 or $400 to spare, but I am not sure. It just depends on how the parties want it. I could put in concrete culverts, or if the parties want it cheap I could put in cedar. The street may settle here and there, so we must have concrete culverts, and it will cost about twice as much as cedar. Now, in assessing, I refer to the plan which is in my report. I recommended that the assessment should be equal per foot frontage right through, but I reserved this special section G, that in the first place there should be a deduction of sixty feet, that the assessment shall be one-half only of the assessment of all the other property. That is the way the thing is to be done. Now, it sometimes occurs that parties send in a petition, and when the Clerk comes to look it up it is not sufficiently signed; that is, there is not a majority, two-thirds of the ownership, and they don't want to go back on that, and our Council had an amendment made so that they could initiate certain things, even if the petition was not sufficiently signed, and then there is a certain procedure. In one case they wanted us to initiate the work, but I said we wouldn't have anything to do with the matter. They would like the matter to go on, but they don't want to pay. In that case, the Council recommends on the report of the Engineer and the work goes on in that way. Now, I will just read you from the by-law about the flankages. The by-law says lots at the junction of streets, for instance; if the work is done along the long side, we can allow sixty feet off, but supposing it comes in the case we have on hand, that the man has a frontage of 110 feet and a depth of 100 feet, we exempt 60 feet off the frontage in that case, and the difference is only 10 feet in length. So we have a section here. (Reads.) That is, we can improve it on the side the improvement is done for the fifty feet over the sixty.

Now, I understand that there are some of you young surveyors located near cities and towns and villages, and there is no reason why you shouldn't take up this matter and post yourselves on it, something like the Provincial Drainage Act, for instance. It is a great deal easier when you study these things first and then go out in the bush. I always hold that the Board of Examiners should keep pushing matters up and making the examinations different. I think the surveyor should be a practical engineer as well. If you are accepted as an authority, you must know all about it. Then there is the Survey Act. Mr. Niven takes the young men into a room, and they go up to the blackboard in fear and trembling, and he finds there are lots of things the boys don't know. He

asks them, "Did you ever hear a lecture on the Survey Act? Did you ever ask about it? No. Then you are to blame yourselves."

Now there is the Registry Act and the Survey Act, and lots of things which it is your business to read up so as to master the details. Suppose a lawyer wants you to be a witness, and you are in the witness box, you ought to be master of the subject. A lawyer once told me a lie is as good as the truth, if you only stick to it. You want to be prepared thoroughly on every part of the Survey Act, the Drainage Act, and the Local Improvement Act; people want you to know everything; they expect it of every surveyor, and if you don't they don't want you. Now the Corporation is of the same way of thinking, and the members of the Council are the same. They don't know anything at all and they expect you to know all about it; but you must lay it before them in a pleasant way, so that they think it is they who know all about it. In the Council meetings I sometimes have to suggest certain things or object to certain things, but you have to learn how to do it. I don't see any necessity for saying anything more on the matter, but when you have anything to do with local improvement work you will perhaps understand more about what I have said.

DISCUSSION.

Mr. Rorke—Do you make a schedule giving a list of the owners and their total assessments?

Mr. Gibson—I prepare a plan and leave it with the Clerk to put in the names of the parties. (Mr. Gibson illustrates on plan.) It furnishes a statement of all the frontages and the exemptions and the flankages and all these things. Then the Clerk knows the names of the parties and knows the lots.

[This Association is not responsible as a body for the opinions expressed in its Papers by Authors.]

PAST, PRESENT AND FUTURE OF NIAGARA FALLS.

BY THOS. FAWCETT, DOMINION TOPOGRAPHICAL SURVEYOR, NIAGARA FALLS.

As time with its unvarying wheels rushes on, the lessons taught by this, one of the greatest and most interesting of Nature's architectural works, speaks to the human race with changing accents and sentiments. Three hundred years ago, when this mighty cataract was known only to the red man of the forest, who was the sole occupant of the country, and who as he travelled through the wilderness had to make an eight-mile portage from the foot of the rapids, near Queenston, to a point above the Falls, this part of the journey between the great lakes would to many a weary traveller appear as a great obstacle in the way of his progress, a something to tax his not over-willing energies to their utmost; yet there was that which produced a feeling of reverence and awe as he looked upon the great fall and listened to its mighty roar, which in those primitive times was unmixed with the various noises which come to us as a result of civilization through the turning of thousands of wheels and the din of many whistles, which break the silence at that period unbroken by any sound not emanating from Nature itself in the primaeval forest. It spake to those primitive navigators with the voice of a god, and not a god who dwelt at a great distance, but one who was nigh, "The Spirit of Niagara," the "Thunderer of the Waters," who demanded yearly sacrifices, in the shape of human lives, to appease his wrath. There is a legend that in addition to the lives given through accident, the Neuter tribe of Indians, who owned the land on both sides of the river, between the two lakes, every summer selected the fairest maiden in their tribe for sacrifice, decked her with flowers as a bride, and sent her over the Falls in a snow white bark canoe, and that after the body was recovered it was buried with ceremonies on Goat Island. This island, the supposed abode of the spirit, was held sacred by them, and any one who would camp on it overnight they thought would incur the anger of the great spirit, whom they supposed would not delay in exacting the full penalty for such presumption. With such a belief it is not probable that many would take the risk unless for

the purpose of suicide. Probably to those people in the dawn of civilization, as to people in our own day, the rushing waters would attract and fascinate its victims until they could hear the waters calling them, and in obedience to the supposed invitation would plunge to their deaths. The impressions made by the Falls on first sight, with its magnificence, its deafening roar, its matchless power and unconquerable rapids, is much the same to all people in all stages of intellectual development. It tells of a power supreme, stupendous, magnificent. Its treacherous rapids above, its mountainous billow and whirlpool below, defend it against encroachment by means of navigation for over a mile above and for several miles below. It says to the adventurous boatman, "So far shalt thou go, but no farther." No one can look upon this great cataract for the first time without a feeling of awe and reverence. If any sight in nature will impart the idea of omnipotent power, this view of Niagara Falls will impress one in that way. Of the many poems which have been written as tributes, the writers link the idea of the Great Architect of the universe in some way with what they behold in this great cataract. Other fluent writers have acknowledged their inability to convey their impressions with pen, and have declared the subject as beyond their power to describe. One writer expressed himself thus, "I came to see, I thought to write, I am dumb." Another scribe of a kindred mind says, "I saw Niagara. Oh, God! who can describe the sight?"

It is not known with any certainty who the first white man to visit the Falls was, or the date when this first visit occurred, but it is probable that one of the men who accompanied the great Champlain on his exploratory voyages was that man. The first reference to the great cataract is found in the report by Jacques Cartier, who reached the St. Lawrence River in 1535, who must have obtained his information from the Indians whom he met. The location of the Falls between Lakes Ontario and Erie was first shown on a map illustrating the voyages of Samuel Champlain in the year 1613. It is known from Champlain's reports that he was on Lake Ontario as early as 1613, and it is conjectured that some member of his company visited the Falls that year. Father de la Roche Dallion was known to have been on the Niagara River as early as 1626, and it is almost certain that he saw the Falls, and he may have been the first white man who had that honor.

The first picture of the Falls was from a sketch by Father Hennepin, published in the year 1697. This picture showed the Falls in three channels, instead of two, as at present. A rocky island or large rock on Table Rock subsequently undermined and broken off, at that time divided the Horseshoe Fall into two parts, which now occupies one large curve. There are few places where the intelligent student of Nature can study its laws and operations

with equal advantage. Sir Charles Lyal, the eminent geologist, found the Niagara Gorge a veritable mine of information as to the relative lengths of the ages required by Nature to grind down and level up, to elevate and depress the various portions of the globe while making it a fit habitation for the crowning work of creation, viz., the advent of man. The position of the great Fall itself, and the rate at which it is wearing its way up stream, is a measure of the time it took to excavate that great gorge now some seven miles in length between the escarpment at Queenston Heights and the present location of the Falls. Dr. John Hall, State Geologist for New York State, who made a trigonometrical survey of the river, planted monuments near the shore on the American side in the year 1842, to be used in determining the rate of recession. When the comparison was made, a third of a century later, it was found that the apex of the horseshoe itself had receded fully one hundred feet in that time, being at the rate of three hundred feet in a century. The time required to excavate the entire gorge at that rate would be about 12,320 years, but in some places the change was scarcely noticeable, and those who have given the subject much study have fixed the mean rate at about one foot per annum, which would bring the above period up to near 37,000, differing not greatly from the time deduced for this era of our planet's history by Lord Kelvin and Prof. Newcomb, through other methods of calculation. If Niagara River flowed on the surface of the ground it would be running up hill from Lake Erie to Queenston Heights, as the escarpment there is some 38 feet higher than the ground at Lake Erie, and there is evidence that before the glacial period, or age of ice, the water found its way to Lake Ontario by another route, running almost due west from the present whirlpool, six miles or thereabout, to a point near St. Davids. The deposits left in this old channel by the drift was more impervious to the pressure which for ages must have tried to remove the obstacles deposited during the ice age, than the solid rock itself. The old channel, with its boulder and clay deposits, is easily traced out to this day, and will likely remain so for all time. When the water began to flow over the escarpment at Queenston the fall would be over 100 feet higher than it is at present. The whole country back of that must have been covered with water, Lake Erie occupying a vastly greater area than it covers to-day, and we can conceive the force of the water and spray after descending from this great elevation excavating the shaly rocks and undermining the harder limestone beds, just as it is doing to-day at Niagara Falls, until the overhanging portions yield to the pressure and break away. Thus the excavating process began, and thus it has continued and will continue as long as the water from the great lakes continues to flow in the same direction. The present height of the

fall, which on the Canadian side is some 158 feet, is the least elevation there has been since the beginning thereof. As it recedes it will again become higher until the top of the rapid is reached, where the elevation is 52 feet greater than the brink of the Falls. The general slope of the river bottom from the Falls to Queenston is 15 feet per mile, and assuming that the rate of recession shall remain at one foot a year, those who are living 4,000 years hence will look upon a fall 200 feet high, and that sixty thousand years farther on, the fall will have disappeared and there will be nothing but a rapid twenty-two miles in length. I venture, however, to make the prediction that the time will come, and not many decades hence, when through the interference of man the rate of recession of the Falls will be very much retarded, if not altogether terminated. Already concessions have been granted to some four or five companies for the appropriation of 30 per cent. of the estimated water-power of Niagara Falls, and about half of that amount is already under harness. Not until the last half of the past century did Niagara say to the human race, "You can make use of me instead of coal and wood, to run your machinery and run your railways, to light your houses, cook your food and melt your ores, to do the work of millions of human laborers and overworked horses." At first its voice was unheeded. Men were not prepared to risk their money in untried and unproved schemes. The water had been used in a small way to turn the wheels in a mill at as early a date as 1750, but the idea of generating power or force that could be transmitted over a small wire to distant cities and towns was one of the things that had to be revealed, and the utility thereof proved by the present generation. The youngest member of this Association had reached school age before power development under anything like a large scale was commenced by the construction of the great tunnel on the American side nearly a mile and a half in length, large enough to return the water to the river below the Falls after producing power by means of twenty dynamos to the extent of 120,000 horsepower. The plans adopted in carrying out this great scheme were not the work of any one great mind, but the combined result of plans submitted by the most eminent engineers in the civilized world. An International Commission composed of representative engineers from England, France, Switzerland, Germany and the United States was appointed, with headquarters in London, England, to receive and examine the plans of all engineers who desired to compete for any part of the work. The plans finally adopted were the result of the investigations by this Commission, of which the celebrated scientist, Sir William Thompson, better known as Lord Kelvin, was the chairman. A similar plan was adopted with a very much shorter tunnel on the Canadian side, under the title of "The Canadian

Niagara Power Company," with a capacity of 110,000 horsepower, the powerhouse standing close to the head of the Falls. The next company to obtain a charter was the Ontario Power Company, who adopted the plan of bringing the water from near the head of the rapids in a steel pipe eighteen feet in diameter, which is buried underneath the surface of the ground, imbedded in cement for a distance of upwards of a mile to the brink of the gorge at the foot of the Falls, from whence the water drops down penstocks to the turbines below, which turn the machinery in the powerhouse at the foot of the Horseshoe Fall.

The Electrical Development Company, more distinctly a Canadian company than the others, having profited by the experience of the other companies, selected a point in the river about half way up the rapids, and after constructing a coffer dam which was considered one of the greatest engineering feats of the age, to exclude the water from that part of the river bed where they wished to construct the wheel pits and build their powerhouse, they successfully excavated a tunnel in a straight line from their turbines to a point under the Horseshoe Fall, near its apex. Consequently the water used by this company in generating the power which, when their work is finished, will amount to 120,000 units, is not diverted from the stream, but simply dropped to a lower level beneath the surface of the rock, to emerge again and mingle with the water that falls over the brow of the cataract. These different schemes of power development have been fully explained and illustrated by photographs and sketches in different engineering magazines and journals, where a full description of them may be found by those who would wish to understand the details connected with those great feats of engineering and construction, for the more closely you examine the work the more admirable it appears, for every provision necessary that these vast machines should do the work assigned them with the least possible friction, and the parts so nicely balanced, that any one part getting out of gear or becoming disabled would be rather the exception than the rule. Every emergency seems to have been anticipated and provided for. This noble work of bringing this great waterpower under subjection has not been allowed to go on without protest, especially within the few months past; the cry of vandalism has gone up throughout Canada and the United States, more particularly in the United States. It has been averred that this, the grandest of all sights provided by Nature, was on the eve of destruction. Journalists, members of Congress, and private citizens have raised their voices alike against this commercial use of the waters of Niagara.

In the estimation of these protestants the commercial value of the electric energy developed was not to be compared with the loss to humanity that the threatened destruction of this wondrous

sight would bring, and so intense did this sentiment become that the aid of the International Water Commission was solicited to, if possible, put a stop to the whole scheme. Some would go so far as to prevent, if possible, those companies who have the bulk of their work completed, from finishing the work of development authorized under the several charters. The National Government of the United States and the Dominion Government of Canada have both been solicited to take the matter in hand and save the Falls. The Burton Bill, which passed the United States Senate, has for its object the limitation of power development to the amount already authorized by charter and at present under construction. The Dominion Government has been memorialized to place a prohibitive export tax on electric energy to ensure a supply of what is generated on the Canadian side for the benefit of Canadian consumers. The electric energy so far developed by the two companies first named above is all sent over the river to be used in running the machinery and railways of the State of New York, and lighting American cities, while the third company has built a transmission line to Toronto, and is thus prepared to supply the Queen City of the Province and the cities lying between this and the source of supply. Should the terms of the Burton Bill be enforced, the United States will be prohibited from importing more than forty per cent. of the power developed on the Canadian side, while under their charters these companies contract to supply the Canadian consumer on as advantageous terms as they supply the people across the border, to the proportion of fifty per cent. of their entire output. It is conceded by those who have taken the subject into their serious consideration, that if the power development should be limited to what is at present authorized and under construction, that little injury will be done the scenic effect; but if freedom were allowed, all who would engage in the business of extracting energy from the great fall, there would ere long be nothing left but an escarpment to look at, and they think the loss to the human race would be incalculable. Others, who look upon the matter from the viewpoint of utility rather than the aesthetic, say, "What difference would it make if all the water were appropriated, so long as it was returned to the stream again?" And herein lies a question, Can a man be said to have appropriated the water or deflected the water if he returns it uncontaminated again to the stream? Take, for instance, the Electrical Development Company, where they simply let the water drop to a lower level a thousand feet further up stream than the rest of the fall has yet cut its way, the stream being unsuitable for navigation of any description for some distance both above and below the wheel pits and powerhouse. I presume this recently discovered wealth embraced in the great waterfall should be an asset of the nation rather than of

the individual. We can scarcely yet conceive the benefit our country and civilization will reap as a result of the advancement of power development. We gradually become used to our electric lights, electric railways and electric motors in running our machinery, but these are only the beginning of what we may look for in the near future. I will venture to prophesy that not many years hence all the railways, all the lighting, and nearly all the factories within one hundred miles of Niagara Falls will be supplied with power from this great fall. Machinery on many of the farms will be supplied from the same source by means of a single wire, over which will be transmitted power, also light and telephone. Our houses may also be heated and food cooked from the same base of supply. Who would venture to say that the present generation should pass laws or rules that would be binding on future generations. Does it not seem to you that the time is coming when this great source of power will all be needed in working out the problems of advancing civilization.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

THE OUTFIT FOR BOTH WINTER AND SUMMER ON GOVERNMENT SURVEYS IN NORTHERN ONTARIO.

BY ALEXANDER NIVEN, D.L.S., HALIBURTON.

Some time ago our Secretary wrote me that "our distinguished President" had suggested as a subject for a paper to be read at this meeting, "The Outfit for Both Winter and Summer on Government Surveys in Northern Ontario," and the Secretary requested me to handle the subject.

Now, although I have handled both winter and summer surveys for a number of years and think that I know pretty well what is required in either of them, it is rather difficult to write on this subject, without repeating what has before been written, inasmuch as a number of our members have from time to time, within the last twenty years, dealt to some extent with the question.

I have thought, however, that a few incidents in my own experience might not be uninteresting to some of the younger members of the Association.

My first survey for the Government was on Manitoulin Island, immediately after the western portion of this island was ceded to the then Government of Canada; in the days when we had a moveable Parliament between Toronto and Quebec.

The Hon. William McDougall was then Commissioner of Crown Lands, and instructions were issued to 4 surveyors at the same time, to lay out 4 townships on this island. We left Collingwood in the fall of the year by the last boat of the season (the steamer "Rescue"), and after a somewhat tempestuous voyage, landed at Little Current on a cold November night, with several inches of snow on the ground. The next day the surveyors separated, each one going to their respective starting points. One of the parties having finished his survey returned on the ice in the following March to Penetanguishene, the other three coming down by the first steamer early in May. Of the 4 surveyors, Mr. Joseph Hobson, now, and for many years past, chief engineer of the Grand Trunk Railway, and the writer, are the only ones now living.

My party numbered 13 all told, the majority of whom I took with me, the remainder being made up from Indians belonging to the Island. My first and second assistants were both Provincial Land Surveyors, their remuneration being $1.50 and $1.25 per day. The men were allowed 60 cents per day. My own pay was $4.00 per day, and 50 cents per day per man was allowed for rations.

In those days, stoves were unknown in camp life, and the outfit consisted of 2 large tents pitched opposite to one another, with a roaring fire between them, and a tent for the cook, to one side of the others.

The snow got to be about 4 feet deep that winter. We put on our snowshoes on New Year's Day and wore them every day till the 20th of April.

Our food was of the usual kind for surveys in the early days—flour, pork, beans, split peas and tea, with a little sugar for the exclusive use of the cook. We carried a muzzle-loading rifle and shot a caribou, caught a few fish through the ice, and I remember that we shot 76 partridges with a horse pistol during the winter.

One of the incidents of the survey was the arrival on Sunday afternoon of about thirty Indians from Wikwemikong, on the unceded portion of the island, to protest against the survey. They served a "notice to quit" upon me, and after half a dozen of them had spoken with much eloquence and many gestures, through an interpreter, I gave them something to eat, and each man a new clay pipe and a plug of tobacco, then, after shaking hands all round, they started for home, and I heard nothing more from them.

Nowadays, on winter surveys, we do things differently. My last winter survey was some distance up the Canadian Pacific Railway in 1901-2. We had a considerable distance to go from the railway to our work, and we had to take our outfit, and about half the supplies necessary for the survey, with us, the other half being taken in by a lumberman from a point farther west on the railway. We used toboggans, and they were drawn by dogs and men, every man in the party having all he could attend to in one way and another.

I had 4 tents made of 10-ounce duck, 10x14 feet, with 3 feet walls, with a small sheet-iron box stove for each tent; the cook had a square stove for cooking, with 4 holes on top, and an oven underneath for baking.

The ground was first cleared of brush and logs and the snow tramped down to make a level bottom. The tent was then pitched and the stove set in one corner near the door, on a timber founda-

tion, the 4-inch pipe being run through the roof of the tent, protected from burning by a piece of tin or zinc.

A heavy coat of balsam or spruce boughs was then laid all over the floor of the tent, and then a tarpaulin spread over the brush, in the back part of the tent; upon this the blankets were spread, and the tent was then banked with snow outside to keep the wind from coming under the walls. Here one can sit in the evenings and on Sundays and days unfit for working, just about as comfortably as in a house, so long as the fire is going.

On this survey I was running continuous line and the camp was moved every day. The "boss packer" usually went ahead and selected a route among the hills for the toboggans, as close to the line as practicable, and would then select a camp ground about as far ahead as the line would probably be run during the day. The men and dogs having brought forward a load with the toboggans, would return for another load; the "boss packer," and perhaps a man with him, would then make another dash ahead and select a camping place for the following day; the benefit of this being that besides having an idea where they were going to camp the two men would make a good snowshoe track for moving on the following day, which would also have the benefit of a night's frost, for the toboggans. By the time the advance guard would return the other packers would probably have most of the outfit forward and they would then set to work and put up the tents, and get wood for the night, and for this purpose they carried in the outfit a cross-cut saw.

It was also the business of the "boss packer" to make a trip from the camp ground to the head of the line some time before evening, to let the line party know where to find the camp.

The "boss packer," as will be readily understood, is a very important man on a trip of this kind, and it is surprising to see how well he will sometimes locate the camp for both alignment and distance. Once he said to me in the evening: "The camp to-morrow night will be at the edge of a small lake just about where the line will cross. I think you will get the line there by evening, and I shot a moose close by to be ready for supper." And it turned out just as he said. A man who can do this, and take charge of the packers and get the outfit along to the best advantage is invaluable, and the question of wages to such a man is not worth considering.

SUMMER SURVEYS.

On summer surveys the outfit required is of a different description.

[illegible] under the heading "Survey of the [illegible] in Northwestern" by James Robertson, C.E.S. [illegible] necessary [illegible] I need not repeat [illegible]

[illegible] last summer when [illegible] vassals.

My [illegible] the [illegible] Railway to Missanabie Station [illegible] Nipigon [illegible] by canoes [illegible] the height of land or watershed between the waters [illegible] Superior and those flowing to Hudson's Bay. The portage is about [illegible] 12 miles in length. We are now on the waters of Missanabie Lake and the course is northeasterly [illegible] the river of this name, near which is [illegible] Station. [illegible] Bay [illegible] through these lakes the Missanabie River [illegible] many rapids and around many falls [illegible] the east and west lake are [illegible] 1900, [illegible] the Nipigon. The Transcontinental Railway will cross this [illegible] the work of building commenced.

My [illegible] four large lines and [illegible] with and to take long the [illegible] the axes. The axe was to feet long, 30 inches wide and 12 inches [illegible]. The large axes were from 18 to [illegible] inches wide and [illegible] inches in depth. My largest [illegible] pounds, with 2 men across [illegible] was [illegible] a safe load—[illegible] 800 pounds [illegible] in an ordinary sea.

My party [illegible] with the following supplies: 3,000 pounds of [illegible] pork, 1,400 pounds of [illegible] 400 pounds [illegible] 300 pounds sugar, 100 pounds split peas, 100 pounds oatmeal, 100 pounds rice, 4 hams, [illegible] pounds sausage, [illegible] pounds of black tea, 30 pounds [illegible] 2 pails of bee syrup, about 80 lbs. [illegible] 100 pounds apricots, 100 pounds [illegible] 50 pounds raisins, [illegible] pounds evaporated potatoes, [illegible] pounds baking powder, [illegible] cases condensed cream, 2 cases canned beef, 33 pounds [illegible], [illegible] pounds coffee, 1 box soap, 70 lbs. [illegible] pounds wax candles, [illegible] pepper, 12 tins [illegible], [illegible] lbs. [illegible], [illegible] boxes matches, [illegible] pounds [illegible], [illegible] essences of lemon and vanilla, [illegible] of [illegible]. I may say that I was [illegible] from the time of leaving [illegible] the foregoing list was not [illegible] but [illegible] supplemented by a few

more hundred pounds of the staple articles mentioned therein. Evaporated apples is not mentioned in the list, the reason being that I could not buy them in Toronto at any price. They were not to be had.

In the matter of tents my practice has been for many years to use the small wedge tent made of drill 7 ft. x 7 ft. x 7 ft. I have one for myself, one for my two assistants, and one for every 2 or 3 and sometimes 4 men. These tents are easily put up, and are more convenient to handle than tents of larger dimensions. You can often get a place for a small tent when you cannot find a place for a large one without a good deal of clearing away of brush and grubbing of stumps and roots, and besides the men like them better. Every 2 or 3 men keep their own tent and blankets together, pack them up every morning, putting them into bags, and always know their own outfit. My cook's tent is about 8 by 10 feet, with 30-inch walls, and this he occupies alone. I carry one rifle in the party, and sometimes a shotgun. Revolvers are only a nuisance in the camp and should be left at home. I provide my men with 2½-lb. axes, with 34-inch handles, and I always have one brush hook on the line if I can get a man to use it.

How the survey was conducted, and the country through which we passed described, is it not written in the chronicles of the Department of Lands, Forests and Mines?

Discussion.

The President—The list of rations reminded me of the old days thirty-five years ago. If the men of that time saw and read the list of rations, they would think these men were living at the King Edward Hotel. This paper is of peculiar value, not only for the present, but for the future, just as we are interested in seeing what was done when they were making the first surveys in Canada, or the early surveys of fifty or a hundred years ago. Those who come in the future will appreciate very much the details of Mr. Niven's paper.

Mr. Blake—How many cooks did you have?

Mr. Niven—One.

The President—During what time were the supplies being used?

Mr. Niven—About four months.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

THE DETERMINATION OF A PORTION OF THE ONTARIO AND QUEBEC BOUNDARY.

BY T. J. PATTEN, O.L.S., LITTLE CURRENT.

Pursuant to Orders in Council by the Ontario and Quebec Governments, the writer, in conjunction with Mr. F. C. Laberge, P.L.S., of Montreal, who acted as commissioner in behalf of Quebec, proceeded in July, of 1905, to define that portion of the boundary between the Provinces of Ontario and Quebec lying between the 42nd mile post at the height of land and O.L.S. Speight's base line, a distance of nearly 100 miles. In the summer of 1906 Mr. Laberge resigned, and was succeeded by Mr. J. H. Sullivan, P.L.S., of Valleyfield, Quebec.

The boundary to the height of land had been determined by a meridian from the head of Lake Temiskaming in 1873-4 by Messrs. J. L. P. O'Hanley, P.L.S., acting for Ontario, and W. W. O'Dwyer, P.L.S., for Quebec. Mr. Niven's paper in proceedings of O.L.S. Association, 1896, gives a detailed and very entertaining description of their work.

Very full instructions, identical, of course, were issued from the Department of Lands and Forests for each Province, and were in short, to run a meridian from the 42nd mile stone monument to O.L.S. Speight's base mentioned above, and plant iron and wooden monuments at every mile, the line to be cut six feet wide on level ground.

Our party consisted of sixteen laborers, two assistants, one cook and ourselves, making a total of twenty-one, and all worked as one party. Such a large party necessitated at the commencement the transport of about 10,000 lbs. of supplies and camp outfit and iron posts.

The execution of the work differed very little from that of a base or meridian line, except that probably on account of greater precision being expected a wider cut in the forest to admit of long sights was necessary. The methods pursued were as follows:

The azimuth of Polaris was determined by the usual elongation method by two transits independently, and a mean of the dif-

ference, which was never more than a few seconds, was taken. As it was well on in August when the determination of the line was commenced, the elongation method was found not at all inconvenient, as the camp was planted near the end of the line whenever an observation in the evening was agreed upon. Our method of observing was to place the transits so that when the telescopes were pointed to Polaris, a straight line would pass through the axes of the telescopes, or, in other words, they were side by side; then a large tree about 100 yards distant, towards Polaris, was felled at right angles to the line between the transits and the star. The space between the transits was then compared with that between the sights to Polaris, marked on the tree.

A short Hungarian nail directly underneath the flame of the candle was soldered on the bottom of a small lantern. With this nail the log was punched very conveniently in the line of sight to the star. Care was necessary to have the nail and flame in the same vertical plane, but with a short candle this was not difficult.

In producing the line the usual method of reversal sights were taken to a steel picket on a hub, and a tack driven at the mean.

In the mountainous country, south of Abitibi Lake, sights were taken from hill to hill and sometimes reached a length of about 100 chains. The line in the intervening valleys was carefully run with a transit.

Mr. Laberge used the transit at the main pickets on the hills and the writer was usually assistant to the picketman, being more familiar with the language and peculiarities of the Indian axemen. This gave Mr. Laberge ample time for reflection and to work calculations, also to kill mosquitoes and smoke le tabac Canadienne.

The chaining was carefully done with a standard 66 feet tape, and when a mile was measured, it was carefully remeasured, going south, with a 100 feet tape. Whenever discrepancy enough to suspect an error was shown, it was remeasured. Each chainman held an ordinary plummet at the end of every tape length, on level ground as well as on the slopes.

At the end of every mile an iron post of heavy pipe, 1⅞ inches diameter, forged at the top and pointed similar to those planted on the base and meridian lines, was planted. Also a 6-inch wooden post close to the north side of the iron one. On the proper sides were marked Ontario and Quebec and the mileage in Roman numerals on the south side. Bearing trees were then marked in the ordinary way.

In the triangulation across Abitibi Lake, a total width of about

11 miles, but broken by islands, some large triangles were necessary, the greatest width of water being about four miles. In order to get sufficient length of base for these triangles,—the longest base was nearly a mile,—it was necessary to survey the shore line and find the contour of the ground along the line of the proposed base, in order that the base, when started, would not intersect too wide a bay or cross a higher elevation than that at each end of it.

A small rock near the line in the four mile stretch on Abitibi Lake was very convenient in producing the line. From it signals were given to the picketmen across the lake. This rock was called Speight's Rock on account of having found on it one of the pickets of his micrometer survey.

The topography of the adjoining country was shown as accurately as time would permit. Of large rivers and islands a stadia survey was made, and of less important ones a track survey or sketch.

The surveys of the Transcontinental Railroad were intersected in the 90th and 91st miles, about 8 miles north of Abitibi Lake.

The closing with Mr. Speight's 70-mile post on his base line, which he planted in 1900 to mark the approximate position of the boundary, was very satisfactory, the line passing only one chain and ninety-three and a half links east of it. This was the closing of a block of at least 100 miles long by 70 miles wide.

A plan, showing the line and all the natural features of the country, which we surveyed or sketched, was drawn on a scale of 40 chains to an inch.

The country at the height of land is sandy for 3 miles to Labyrinth Lake. From there it is a succession of high rocky ridges and hills, to near Abitibi Lake. From Abitibi Lake for about 15 miles to the divide, it is farming land, then a few miles of sand and boulders and rock to where the line descends to the valley of the Hannah Bay River, which is good farming land. About three miles from Speight's base the great muskeg was entered. The line throughout was heavily timbered with jack pine, white and black spruce, poplar, Balm of Gilead, balsam and white birch.

In the season of 1905 the line was located to the Okikodosek River, which flows into Abitibi Lake on the north side, a distance of nearly 46 miles.

In the season of 1906 the work on the line was resumed on 1st of August and completed on Sept. 27th. About one mile per day was the average rate of progress on the line, which included all delays for bad weather, etc.

A few incidents by the way may prove interesting. The Quinze

on the Ottawa River is well known on account of several dangerous rapids. One of our assistants, W. S. Jardine, had an exciting experience at the second rapid from Quinze Lake last season. He, with two Indians, was bringing an empty canoe up, the Indians poling in the canoe, and Jardine (we called him "Billy") hauling on a rope. When they had reached the top Billy jumped on a boulder on which two saw-logs were balanced, and not observing that the logs were insecure, ran out on one of them. In an instant Billy and the canoe, and logs, were going down stream about 100 miles an hour, but all managed to work near shore some distance down to where there was less current in the rapids, and they hung on until rescued, and thus avoided a very bad rapid farther down, which to have gone through meant certain death.

Mr. Sullivan, the Quebec Commissioner for 1906, brought only two men besides his assistant from Quebec with him, and as they were absent a good deal with the canoes, he sometimes looked round for company and a change of pastime from pedro or reading. The Ontario men were nearly all Indians, even to the cook, and Mr. Sullivan would try to get them to talk a little English. One rainy day, addressing the cook, who was gifted with plenty of assurance and quick wit, he said: "Well, Baptiste, why don't you talk some French or English? I think if I gave you a good horn of whiskey you would speak it first rate." Baptiste said very quickly: "Guess you got some whiskee, juss gimme little and try." His answer surely deserved a drink. John Jack another Ontario Indian, who had some dreadful Indian name, was a prepossessing fellow, always smiling and ready for anything, but he understood very little English. This did not prevent him from making an answer in Indian to anything said to him. One morning when Mr. Sullivan came out to breakfast John Jack was the first man he saw, so he said to him: "Well, John Jack, are you on your good behavior this morning?" Looking a little surprised and serious, he replied: "Caw." (No.)

On nearing Abitibi Hudson's Bay post last season, we were met by Dr. D'Arcy Wood, who accompanied the Indian Treaty Commissioners, and had remained at Abitibi to help to care for the Indians, who were dying very fast with measles. We camped over Sunday a distance from the post, and could see the ghost-like figures of the women with white quilts or rabbit-skin blankets around them, going round from house to house. Our Indians were a little concerned, and had no intention of visiting their northern brothers; they were afraid it might be smallpox. At times during the night, the bell was tolled when a death occurred, and Sunday morning while waiting for breakfast it tolled for four deaths. 42 died in a short time. It was our intention to procure an Indian

at Abitibi who knew the country north of Abitibi Lake along the boundary. On account of the measles we were unable to do so, but after running to the height of land between Abitibi and the Hannah Bay waters we found one who knew the country, but could not go with us. We engaged his step-son, named Joe, who lived there, but when we questioned him pretty closely about the country over the divide he did not seem to be very sure of anything. At intervals the old man came to our camp to bring us game, and we got some information from him. We spread out Mr. Speight's map of that country showing the Hannah Bay River nicely drawn, and after showing him where we were on the map, also the projected boundary line, Abitibi post, and some other points that he knew, we would ask him to sketch the lake and river which he said our line would run near. He would then take the pencil and after making a few flourishes in the air, would make a dab and a few scratches and get over to the Hannah Bay River, which he seemed to admire very much, and liked to linger over it; perhaps he chuckled over visions of heaps of muskrat or mink, or perhaps he thought it looked so much more like a river than anything he could draw. After awhile we got him down to business, and after drawing a river and a few scratches resembling crows' feet to represent two rivers emptying near the same point into another river, we identified it as the confluence of the Woman and Burnt Bush Rivers with the Hannah Bay River, and felt that we had accomplished something, as our line was to cross Hannah Bay River near there.

We gave him plenty of tobacco, and I think the cook gave him an occasional chunk of fat pork, as we had plenty of it. He came afterwards and brought us some beautiful large speckled trout.

At about the 123rd mile post our provisions on the line were nearly done, and the canoemen with the supplies did not come round as arranged. Fearing there might be some misunderstanding, we kept men in the bush hunting them for a day or two, but with no success; then, after a day of drenching rain, with only a little flour soup, we made a business of hunting them, and sent parties in every direction. In the afternoon one of the parties returned with the men and lots of grub, which made us feel comfortable again, as we had very little to eat, the small game was very scarce and Abitibi post was some days' distant, and, what made matters worse, two of the party were totally unfit for a long tramp. The successful party had taken with them a bugle, which one of them could blow well, and after following down the Woman River some miles found the canoemen quickly with the bugle. Sure enough, they had misunderstood about the amount of supplies we had on hand, and were not going to look for us in earnest for some days. One of the party, an Indian, an humble follower of Dowie,

who would not eat pork, reminded us that pork was not good to eat anyway.

A parody which one of the party was guilty of helped our spirits at times when things looked blue. It ran as follows:

Shall we gather at the river?
Where the Nitchees' (Indians') feet have trod.
Gather with the Frenchmen at the river,
As we travel through this land that we laud.

Yes we'll gather at the river,
The beautiful, the Hannah Bay River.
Gather with the Nitchees at the River,
And then we'll get more grub.

When we reach the shining river,
Lay we tape and transit down.
Chuck away the tump line for the paddle,
And whoop it up for the Old Ontario Town.

Yes, we'll gather at the river, etc.

DISCUSSION.

The President—How many miles did you run?

Mr. Patten—We ran to within about 130 miles of James Bay.

The President—How far would it be from Lake Temiscaming?

Mr. Patten—140 miles north of Lake Temiscaming. There are still about 130 miles to run.

The President—In your check chaining with your 66 foot chain and your 100 foot chain, you say they agreed satisfactorily?

Mr. Patten—In the re-chaining of the mile there was a difference of between one and two feet.

The President—I didn't understand about the felling of this tree at right angles?

Mr. Patten—It was merely to mark the direction of the star on the tree. The tree makes a solid mark.

The President—For a rest point?

Mr. Patten—Yes, that was 100 yards away.

The President—That was a pretty short distance. I would prefer it a little longer.

Mr. Patten—With the instrument reading to half a minute you can get it down pretty fine.

The President—You were fortunate, of course, in getting your star. You weren't troubled very much with clouds. A surveyor can observe Polaris at any time that suits him. The main thing is to feel confidence about his calculation, and that is a thing that is a little lacking amongst surveyors. I know they can do it as well as I can, but they haven't got that inward consciousness that it will be all right. If you take it in the evening you can see Polaris very well.

Mr. Patten—We intersected Mr. Speight's line at about 139 miles and 30 chains.

Mr. Niven—How far to the east?

Mr. Patten—1 chain 93½ links.

Mr. Fawcett—Could you give any approximate cost per mile?

Mr. Patten—The line in 1905 cost about $178 per mile. Last year it cost about $200 per mile. Of course a great deal of the time was occupied in going and coming. Each Department paid half.

Mr. Niven—Where did you say you intersected the Transcontinental line?

Mr. Patten—About the 91st mile west of Abitibi Lake.

Mr. Niven—What mileage was it on your line where you intersected the railway line?

Mr. Patten—The 91st mile. We cut a very wide line, six feet wide, on the level; we took long sights, which necessitated a wide line.

Mr. Niven—They started by cutting it about two rods at Lake Temiscaming, and then they got down to 12 feet, I think.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

A FEW REMARKS RESPECTING COBALT.

BY J. F. WHITSON, O.L.S.

This paper will be very brief, as I merely wish to draw the attention of the members of this Association to the great necessity of making more accurate surveys of mining locations.

After having spent several years in the Surveys Branch of the Department of Lands, Forests and Mines, during which time it has fallen to my lot to check over a great many of the mining surveys that have been filed during that time, and as until the opening up of the Cobalt mining section in 1903 mining properties were not considered of very great value, consequently the surveyors were not called upon, owing to the extra expense entailed, to make very accurate or expensive surveys. In the survey of iron and nickel mining locations it was not considered of the greatest importance, whether the bearing of the lines was a few minutes to the right or to the left of the proper bearing, as a few inches or even a few feet mattered very little. Not so, however, in the case of the rich silver veins in Cobalt, where a vein two or three inches in width of almost pure silver made in itself a valuable mine.

It is found that the first surveys in the silver district, made before the township was sub-divided into lots and concessions, were not as accurately made as might have been. As the lines laid down on the ground in the original survey of a mining location are the true and unalterable lines, no matter whether the true course as found on the ground agrees with the bearings and distances as given on the plan, the work on the ground must govern.

Had the original surveys of some of the first locations laid out at Cobalt, covering the richest part of the area, been on a true course, as given on the plans and field notes, three of the richest mines would not to-day be owned by the companies or individuals which now hold them. Very rich veins have been found either crossing or paralleling the division line between the claims, veins which are estimated to be worth anywhere between one hundred thousand dollars and a quarter of a million.

I might also point out that in some instances the surveyors

have been very careless in the planting of monuments to mark the angles of the locations, and as soon as the miner starts to clear off and burn the timber on his claim these corner-posts soon disappear and numerous lawsuits will result in the establishment of these location corners. In this connection it has been suggested that if a mining claim is worth surveying, it would not be out of place to expend a few extra dollars in planting iron bars or permanent stone monuments to mark the different angles.

After the Township of Coleman was sub-divided and a very accurate survey was made of it, the Department had great difficulty in having proper surveys made of the aliquot parts of the lots, as under the Act a mining claim comprised the north-east one-quarter of the north one-half, the north-west one-quarter of the north one-half, etc.; in many instances, however, the lots are broken by lakes, which form no part of a lot, and the difficulty has been to make the proper division of the land area, as it necessitated a very accurate survey of the whole lot, including an extremely careful traverse of the shore lines of the different lakes.

As other rich areas in the vicinity of Cobalt have been opened up within the last few months, and are in many respects as promising as the Cobalt section, every care should be taken by the surveyors to carry out the surveys with as great precision as possible. In one or two instances in the Township of Coleman no less than seven different surveyors have been called upon to establish or verify the outlines of a rich claim.

These are the only remarks I wish to make in connection with the surveys of mining locations or claims. I will make, however, a few remarks as to what has been done in Cobalt since the first discovery was made in the fall of 1903.

To-day there are no less than from thirty to forty producing mines within an hour's drive of the Town of Cobalt, and over one hundred mines which are being developed in this small area. Up to the present over six million dollars of ore has been shipped from the camp, and there is at least two million dollars' worth stored ready for shipping at the present time. At fifteen of the most promising mines no less than twenty-five million dollars' worth of ore has been blocked out. In one property alone nearly ten million dollars' worth has been blocked out above the 100 foot level.

As several of the mines which have not shipped much ore have had machinery installed within the last six months, it is expected during the coming summer that a very great deal of ore will be shipped.

The ore shipped from Cobalt is extremely rich in not only silver, but cobalt, nickel and arsenic. One car of ore shipped from

the LaRose Mine is reported to have netted nearly $98,000, or twenty-three tons, after having paid all expenses in connection with the mining and shipping. Another car of thirty tons was valued at $120,000. It is not unusual for carloads of ore to net from $50,000 to $75,000. The expense of taking out this ore is not very great, as up to date the operations have been within two hundred feet of the surface. Very large nuggets or slabs of almost pure silver have been found in the camp. The largest nugget from one of the Nipissing veins weighed half a ton. Several nuggets or slabs from the same property have been taken which run from twenty-five to one hundred and fifty pounds in weight, and from several of the other properties nuggets or slabs of silver have been taken out running from twenty-five to two hundred and fifty pounds. Two boulders found on the Giant mining property weighed together nearly five hundred pounds. The largest individual vein in the camp so far is seven hundred feet in length.

A sample taken from the Trethewey Mine weighing seventy-nine pounds, assayed as follows:

	Per cent.
Silver	66.67
Cobalt	2.15
Nickel	.41
Iron	1.60
Arsenic	7.03
Antimony	9.67
Sulphur	.22
Calcium carbonate	6.72
Magnesium carbonate	1.23
Insoluble	3.29

The value of the silver in this seventy-nine pound sample, at sixty-four cents an ounce Troy, the present market price, is $491.55.

Three tons of ore sampled from one of the Nipissing properties ran as follows:

Containing by Assay.	Value, per ton.
Silver, 7.944 %, 3.089 oz., per ton at 54c.	$1.668 06
Cobalt, 8.93 %, 178.6 lbs., at 65c.	116 09
Nickel, 15.67 %, 313.4 lbs., at 15c.	47 01
Arsenic, 39.56%, 791.2 lbs., at 1c.	7 91
Total, per ton	$1.839 07
There are about three tons in the sample	$5.517 21

One assignment of ore from the LaRose property assayed as follows:

	Per cent.
Silver	57.40
Sulphur	15.94
Antimony	7.92
Iron	3.88
Arsenic	.52

Another sample from the camp assayed as follows:

	Per cent.
Nickel	23.24
Cobalt	4.77
Silver	2.75
Sulphur	2.28
Arsenic	[illegible]
Antimony	none
Iron	[illegible]

[illegible] extending north-westerly [illegible] Montreal River [illegible] forty miles. [illegible] silver and cobalt properties have been staked [illegible] 1,400 claims have been [illegible] few months. In several of these [illegible] silver has been found in considerable quantities. The [illegible] development work has been done. A [illegible] these claims the surface indications [illegible] very likely that the [illegible] from the township of James [illegible] Lake, [illegible] silver [illegible]

[illegible]

[illegible] increasing communication in [illegible] the surveys [illegible]

[illegible] surveys [illegible] Association [illegible] The surveys [illegible] Northern [illegible] Ontario [illegible] the [illegible] Ontario [illegible] Parts of

at $8 a day when it should be at the very least $10. Description, $1. Now, what does a description mean? A man buys some property and he wants a description for his deed. Now, what does the thing simmer down to? He holds his whole title by what the surveyor charges one dollar for. The lawyer's work is practically nil compared to the description. That is the vital thing in the whole deed, and you value yourselves at one dollar to give the man a title to $20,000 or $5,000, or whatever the value of the property may be. Your contribution to that you charge one dollar for. Could there be anything more ridiculous than one dollar for the description? Just think of it! What is a deed, what does it mean? It is the thing the man holds by, and the other portions of the deed are only secondary. It is on your description they hold the property—and you charge one dollar! It is ridiculous. You say it is an ordinary description. It is an ordinary man that will put his hand upon the paper and make the home of a man secure, where he can sleep peacefully, and only charge one dollar.

Surveyors are professional men. Here are two brothers. One goes to the School of Science and serves his term, and afterwards serves another year, or several years, with a surveyor, and he is a professional man. His brother goes to Osgoode Hall to become a barrister, and what is the difference? I see the assistant surveyor is put down at $2. I think you pay $2 for your laborers on the street. You don't value yourselves. Make yourselves cheap and people will take you to be cheap. Make people to understand you are professional men, and the property they own they have to thank you for, and that their title is good. Make a proper description for them and charge them for it.

Mr. Jones—With reference to the charge for description, I have found a discrepancy between the charge of the surveyor and the solicitor in making out the deed. As a rule, the solicitor doesn't come to the surveyor unless it is some crotchety description that he cannot make out himself, and in that case he comes to the surveyor to have the description made out, and the surveyor then charges not less than one dollar. The solicitor then copies it into the deed and charges anywhere from three to five dollars for copying it in the deed, whereas the man who really does the work and makes it out gets the dollar. That seems to me rather absurd, and there should be a little more equalization of the fees.

[*The Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

DESCRIPTIONS OF PROPERTIES

BY A. J. VAN NOSTRAND, O.L.S., TORONTO.

This subject has been from time to time written up and discussed by members of this Association during the past twenty years and yet the interest holds. Conditions are changing and new ones arising to such an extent that we may regard "Descriptions" as a perpetual theme for study and thought for ourselves and an impression for others. We may, also put it novel as a certainty that those unconscious who attempting to follow out descriptions prepared by us under the impression that they describe positively the lands intended to be conveyed, will find out to many faults and imaginings as do we when endeavoring to locate the lands as intended to be described in the instruments of a century ago.

The foregoing assumption notwithstanding it remains the duty of every member of this association who is engaged in land surveying to impress himself in this connection to the best of his ability and opportunity and thus support the claim made long ago by Mr. Sidney Smith, of Shoreham, to the highest authority in descriptions.

To accomplish this it is not merely necessary for him to have command of language sufficient for the expression of his ideas upon the matter in hand but it is also that the ideas imply a knowledge of the law sought and interpretation of the expressions made use of in descriptions.

Will anyone, with the use of language, it is gratifying to know the crown has taken a course this very important upon approaching the matter of an profession and demonstrate to the known Dominion that it has been and continues in the knowledge of its member's competence. Of ignorance, what we of the order generally are admitted.

Apart the claim referred to it is the duty of surveyors, and we feel will subscribe to a general rule, that Surveyors are in many instances the sources of the accuracy of descriptions prepared by those who are the successors of the Surveyors and gives them the

data from which are drawn the enduring lines which when incorporated in a conveyance either make or mar the title to the land involved. Now, while surveys should, of course, be performed with all possible skill and accuracy, it is often possible to so construct a description as to secure the interested parties against inaccuracies which may have occurred in the work on the ground.

A comparison of the more ancient forms of phraseology with those now generally in use shows us that there have been many changes, nearly all of which are in the direction of reducing the length of a description by the omission of synonymous terms and expressions and the lopping off of phrases, the purpose of which is, like that of the vermiform appendix in the human anatomy, undiscovered. There still remain, however, certain expressions, the import of which the writer is free to confess he finds difficult in explaining to pupils who desire to know all that can be learned of descriptions before placing themselves in the hands of the Board of Examiners. The standard answer to enquiries under this head has, so far, been that the expressions are "common to all normal descriptions and their omission might lead to trouble." Some of these queries are as follows: What does "All and singular" mean? "Parcel or tract." Is every piece of land so indefinite as to be equally liable to be one or the other and thus render necessary the use of both terms? "Land and premises." Is the word premises always necessary? "Situate, lying and being." Isn't that tautology? "Containing by admeasurement." Are not many parcels bought, sold, described and conveyed without any "admeasuring" process when breaking bulk? "That is to say." Why not amputate that appendix? To be brief, while one does not like to pose as an iconoclast, does it not seem reasonable that, in view of the fact that descriptions are usually paid for by the parcel and that the age is constantly growing more strenuous, a Special Committee on Phraseology would have it in their power to advance the interests of our members and confer a marked benefit upon the laity.

Be that as it may we are constrained to deal with existing conditions and derive what profit we may from an interchange of ideas on the various kinds of descriptions which come into the field of the average practitioner.

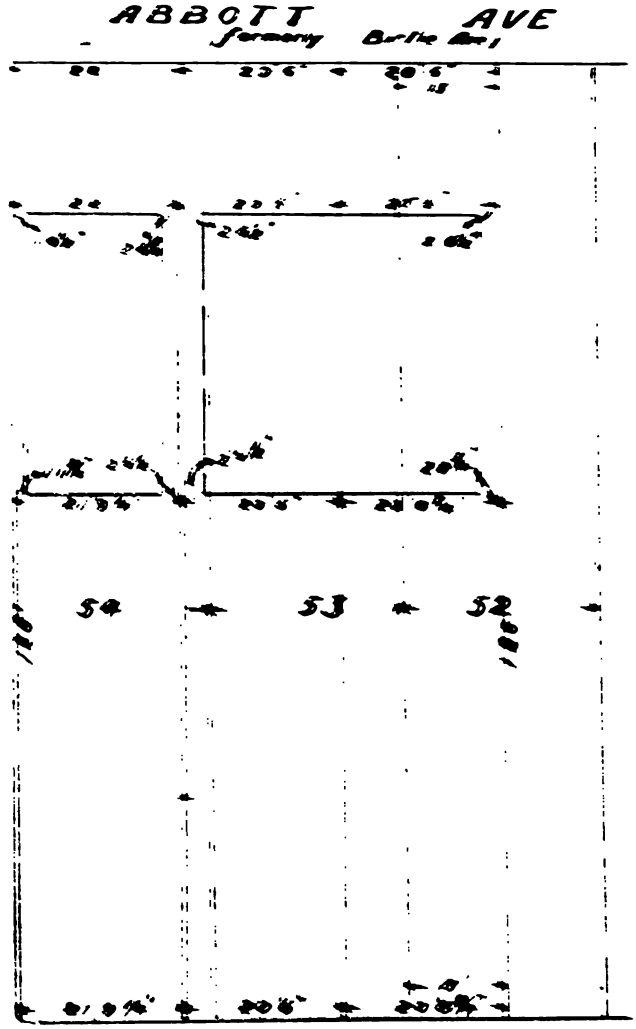
Amongst the many distinct classes of descriptions met with we select a few varieties and leave the remainder for those more familiar with them.

CITY PROPERTIES.

Under this head an experience of more than twenty years has taught the writer that when, at the end of the first two years, he

SKETCH SHEWING
Lots 53 & 54. & the Westerly 13' of Lot 52. Reg. Plan 1156
TORONTO.

To illustrate description



thought he had learned it all, he was, as a matter of fact, just getting nicely into the kindergarten and each succeeding year serves only to place perfection about a decade more remote.

References to the letter book copies of a few years ago show failures which should not have occurred and no doubt the copies of work done at the present moment will some day disclose other deficiencies, but a few specimens are here presented for the purpose of honest criticism. It is, however, stipulated, that allowance be made for the fact that the dimensions of the cloth have a bearing upon the cutting of the coat, and many descriptions are made technically incorrect for the purpose of conforming to (*a*) the available data and (b) the necessity to interfere as little as possible with the previous chain of title.

Case 1.

A semi-detached dwelling house and premises having a joint right of way for side entrance.

ABBOTT AVENUE.

West House of Pair.

ALL AND SINGULAR, that certain parcel or tract of land and premises situate, lying and being in the City of Toronto, in the County of York, and Province of Ontario, being composed of parts of Lots numbers 53 and 54 according to a plan filed as number 1156 in the Registry Office for the Western Division of the said city, and which said parcel is more particularly described as follows:

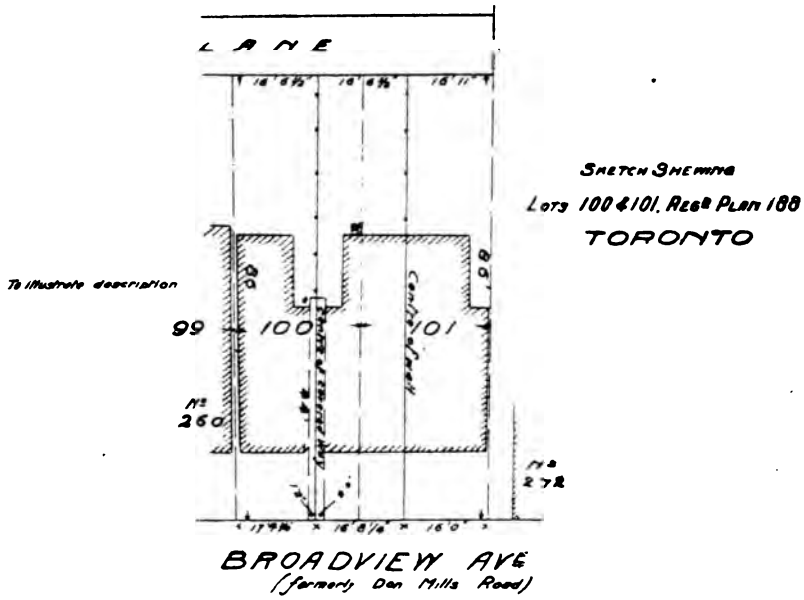
COMMENCING at a point in the southerly limit of Abbott (formerly called Birtle) Avenue, distant forty-two feet and six inches (42′ 6″) measured easterly thereon from the westerly limit of said Lot 54, the said point being in a line drawn parallel to the limit between the said lots from the northern extremity of the center line of partition wall between the semi-detached dwelling houses composing the pair standing in 1906 upon said Lot 53 and the adjacent parts of Lots Number 52 and 54 according to the said plan: THENCE southerly to and along the said centre line of wall and continuing thence southerly parallel to the limit between said Lots 52 and 53, in all, a distance of one hundred and twenty-six feet (126′) to a point in the southerly limit of said Lot 53, which point is distant forty-two feet and three and one-quarter inches (42′ 3¼″) measured easterly from the south-westerly angle of said Lot Number 54. THENCE westerly, along the southerly limits of said Lots 53 and 54 twenty feet and six inches (20′ 6″). THENCE northerly, to and along the centre line of the space between the more westerly one of the said dwelling houses and the next dwell-

ing house to the west thereof, and continuing thence northerly, parallel to the limit between said Lots 52 and 53, in all, a distance of one hundred and twenty-six feet, to the southerly limit of Abbott Avenue aforesaid; THENCE easterly, along the last mentioned limit, twenty feet and six inches (20′ 6″), more or less, to the place of beginning.

TOGETHER with a right of way, at all times, in common with others entitled thereto, over, along and upon a strip of land one foot and six inches (1′ 6″) in width immediately adjoining the westerly limit of the hereinbefore described parcel and extending southerly from the said limit of Abbott Avenue to the depth of fifty-seven feet (57′).

AND RESERVING a right of way, at all times, for all persons entitled thereto, over, along and upon the westerly one foot and six inches (1′ 6″) of the northerly fifty-seven feet (57′) of the said hereinbefore described parcel.

Case II.



BROADVIEW AVENUE.

Centre House.

ALL AND SINGULAR, that certain parcel or tract of land and premises, situate, lying and being in the City of Toronto, in the

DECLINATION TABLE

Inches in Base	50ft	60ft	70ft	80ft	90ft	100ft	110ft	120ft	130ft	140ft	150ft	160ft	170ft	180ft	190ft	200ft
1"	6'	5'	4'	4'	3'	3	3	2'	2	2'	2'	2'	2'	2'	1'	1'
2"	11'	10'	8'	7'	6'	6'	5'	5'	4'	4'	4'	4'	3'	3'	3'	3'
3"	17'	14'	12'	11'	10'	9'	8'	7'	7'	6'	6'	5'	5'	5'	5'	5'
4"	23'	19'	16'	14'	13'	12'	10'	9'	9'	8'	8'	7'	7'	6'	6'	6'
5"	29'	24'	20'	18'	16'	14'	13'	12'	11'	10'	10'	9'	8'	8'	7'	7'
6"	34'	29'	25'	21'	19'	17'	16'	14'	13'	12'	12	11'	10'	9'	9'	9'
7"	40'	33'	29'	25'	22'	20'	18'	17'	15'	14'	13'	13'	12'	11'	11'	10'
8"	46'	38'	33'	29'	25'	23'	21'	19'	18'	16'	15'	14'	14'	13'	12'	11'
9"	52'	43'	37'	32'	29'	26'	23'	21'	20'	18'	17'	16'	15'	14'	14	13'
10"	57'	48'	41'	36'	32'	29'	26'	24'	22'	20'	19'	18'	17'	16'	15'	14'
11"	1°3'	52'	45'	39'	35'	31'	29'	26'	24'	23'	21'	20'	19'	17	17'	16'
12"	1°9'	57'	49'	43'	38'	34'	31	29'	26'	25'	23'	21'	20'	19'	18'	17'
13"	1°14'	1°2	53'	46'	41'	37'	34'	31'	29'	27'	25	23'	22'	21'	20'	19'
14"	1°20'	1°7'	57'	50'	45'	40'	36'	33'	31'	29'	27'	25'	24'	22'	21'	20'
15"	1°26'	1°12'	1°1'	54'	48'	43'	39'	35'	33'	31'	29'	27'	25'	24'	22'	21'
16"	1°32'	1°16'	1°5'	57'	51'	46'	42'	38'	35'	33'	31'	29'	27'	25'	24'	23'
17"	1°37'	1°21'	1°10'	1°1'	54'	49'	44'	40'	37'	35'	32'	30'	29'	27'	26'	24'
18"	1°43'	1°26'	1°14'	1°5'	57'	52'	47'	43'	40'	37'	34'	32'	30'	29'	27'	26'
19"	1°49'	1°31'	1°18'	1°8'	1°0'	54'	49'	45'	42'	39'	36'	34'	32'	30'	29'	27'
20"	1°55'	1°35'	1°22'	1°12'	1°4'	57'	52'	48'	44'	41'	38'	36'	34'	32'	30'	29'
21"	2°0'	1°40'	1°26'	1°15'	1°7'	1°0	55'	50'	46'	43'	40	38'	35'	34	32	30
22"	2°6'	1°45'	1°30'	1°19'	1°10	1°03'	57'	53'	48	45'	42'	39'	37'	35'	33'	32'
23"	2°12'	1°50'	1°34'	1°22'	1°13'	1°6'	1°0'	55'	51'	47	44'	41'	39'	37	35'	33'
24"	2°18'	1°54'	1°38'	1°26'	1°16'	1°9'	1°2'	57'	53'	49'	46'	43'	40	38'	36'	34'
	50ft	60ft	70ft	80ft	90ft	100ft	110ft	120ft	130ft	140ft	150ft	160ft	170ft	180ft	190ft	200ft

County of York, and Province of Ontario, being composed of parts of Lots Numbers 100 and 101 according to a plan filed as Number 188 in the Registry Office for the said county, and now in the Registry Office for the Eastern Division of the City of Toronto aforesaid; and, which said parcel is more particularly described as follows:

COMMENCING at a point in the westerly limit of Broadview Avenue (formerly called Don Mills Road) distant seventeen feet and four and one quarter inches (17′ 4¼″) measured northerly thereon from the southerly limit of said Lot Number 100, the said point being in the easterly production of the centre line of the covered passage way between the dwelling houses standing in 1906 upon said Lot Number 100 and the adjacent part of Lot 101; THENCE westerly, to and along the said centre line of passage way being immediately under the centre line of partition wall between the upper stories of the said dwelling houses, and continuing to and along the line of fence dividing the rear premises of the aforesaid dwelling houses, in all, a distance of eighty-six feet (86′) more or less, to the easterly limit of a lane in rear of the said lots. THENCE northerly along the said limit of lane sixteen feet and six and a half inches (16′ 6½″) to the line of a fence dividing the rear premises of the more northerly one of the said dwelling houses and the next dwelling house to the north thereof; THENCE easterly along the last mentioned line of fence, to and along the said line of partition wall between the dwelling houses last mentioned and along the easterly production of the same, in all, a distance of eighty-six feet (86′) to the westerly limit of Broadview Avenue aforesaid. THENCE southerly, along the last mentioned limit sixteen feet and eight and one-quarter inches (16′ 8¼″) more or less, to the place of beginning.

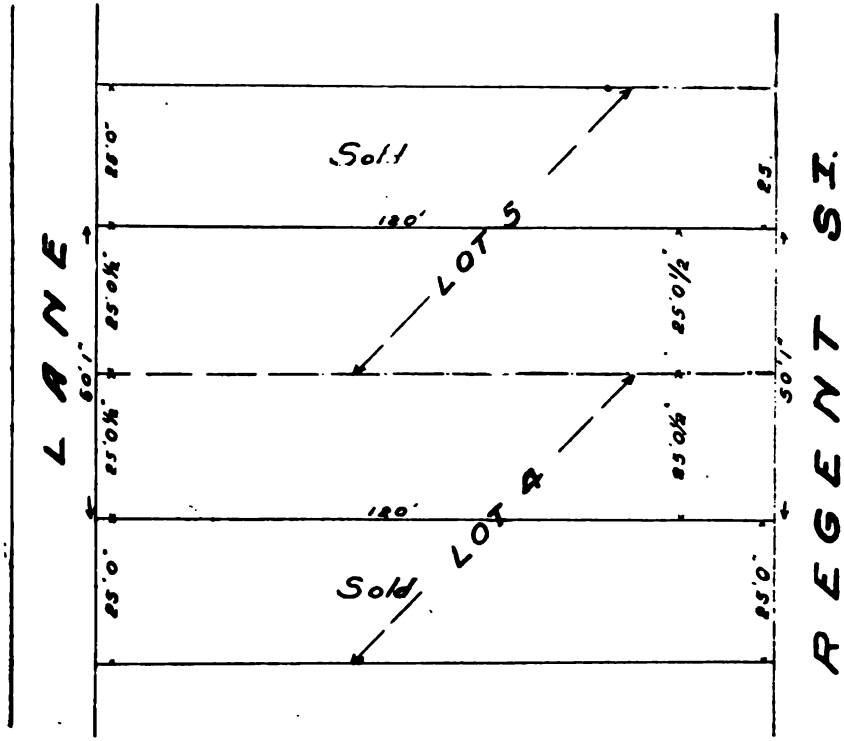
TOGETHER WITH a right of way, at all times, in common with others entitled thereto, over, along and upon a strip of land one foot and two inches (1′ 2″) in width, immediately adjoining the southerly limit of the hereinbefore parcel and extending westerly from the said limit of Broadview Avenue to a depth of forty-four feet (44′).

AND RESERVING a right of way at all times, for all persons entitled thereto, over, along and upon the easterly forty-four feet (44′) of the southerly one foot and two inches (1′ 2″) of the said hereinbefore described parcel.

Such rights of way being limited to the height of nine feet (9′) from the surface of the ground.

SKETCH SHEWING PARTS of LOTS 4 & 5
Regd Plan 22 K.
TORONTO.

To illustrate description



Case III.

REGENT STREET.

ALL AND SINGULAR, that certain parcel or tract of land and premises situate, lying and being in the City of Toronto, in the County of York, and Province of Ontario, being composed of parts of Lots Numbers 4 and 5 according to a plan filed in the Registry Office for the said city as Number 22K, and which said parcel is more particularly described as follows:

COMMENCING at a point in the westerly limit of Regent Street, distant twenty-five feet (25′) measured northerly thereon from the southerly limit of said Lot Number 4; THENCE westerly and parallel to the said southerly limit one hundred and twenty feet (120′) to the easterly limit of a lane in rear of the said lots; THENCE northerly, along the said limit of lane fifty feet and one inch (50′ 1″), more or less, to the southerly limit of the northerly twenty-five feet of said Lot Number 5; THENCE easterly, along the last mentioned limit one hundred and twenty feet (120′) to the westerly limit of Regent Street aforesaid; THENCE southerly along the said limit of Regent Street, fifty feet and one inch (50′ 1″), more or less, to the place of beginning.

This is a very simple form of description, and one which if not used advisedly leads to trouble, as the average conveyancer pins his faith to the registered plan and neglects to provide for coincidence with the limits of lands adjoining.

Case IV.

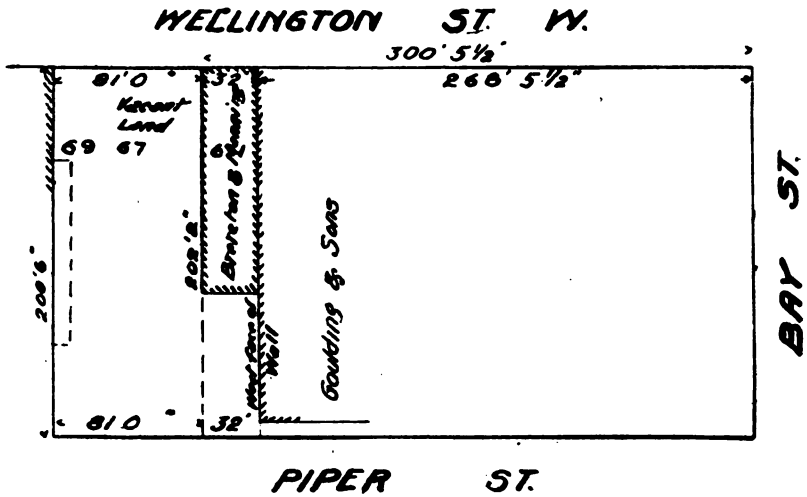
WELLINGTON STREET WEST.

ALL AND SINGULAR that certain parcel or tract of land and premises situate, lying and being in the City of Toronto, in the County of York, and Province of Ontario, being composed of part of Town Lot Number 6 on the south side of Wellington Street West (formerly called Market Street), and which said parcel is more particularly described as follows:

COMMENCING at a point in the southerly limit of Wellington street aforesaid, distant three hundred feet and five and a half inches (300′ 5½″), more or less, measured westerly thereon from the westerly limit of Bay Street, the said point being distant also thirty-two feet (32′) westerly from the westerly face of the westerly brick and concrete wall of the building owned and occupied in 1906 by Goulding & Sons; THENCE southerly and parallel to the said westerly face of wall two hundred and two feet and two inches (202′ 2″) to the northerly limit of Piper Street, as established by City By-law Number 3925; THENCE westerly, along the said northerly limit eighty-one feet (81′); THENCE northerly and parallel to the said westerly face of wall two hundred feet and six inches (200′ 6″) to the southerly limit of Wellington Street afore-

SKETCH SHEWING PART of TOWN LOT No 6
S. Side of Wellington St. W.
TORONTO

To illustrate description



said; THENCE easterly along the last mentioned limit eighty-one feet (81′) to the place of beginning.

SUBJECT to the right of the owners and occupiers, from time to time, of the lands lying immediately to the west of the hereinbefore described parcel, to have and maintain, free from obstructions and open for the purpose of a light well, all that part of the westerly ten feet (10′) of the said hereinbefore described parcel lying south of a line drawn parallel to the said limit of Wellington Street and distant fifty feet (50′) southerly therefrom and lying also north of a line drawn parallel to the said limit of Piper Street and distant fifty feet (50′) northerly therefrom.

Case V.

55 EMMETT AVENUE.

Reservation for Eave Projection.

"RESERVING THEREFROM the right to the owner or owners from time to time, of the dwelling house on the land adjoining the easterly limit of the said parcel, to maintain in its present position, being 1st June, 1906, the westerly eaves of the said dwelling house. the said eaves having a breadth of one foot and six inches (1′ 6″) more or less, by a length of thirty-six feet and four inches, beginning at the distance of thirteen feet (13′) southerly from the said limit of Emmett Avenue, and running thence southerly."

As previously intimated, it is not claimed that any of these descriptions are faultless or even approach perfection, and the writer will feel grateful for criticism leading to improvement, but a few words on Construction may not be out of place. Many Surveyors reverse the order of course and distance, thus, "THENCE one hundred and twenty feet (120′) on a course north seventy-four degrees (74°) east." While not material, it seems reasonable to state the direction one intends to go before specifying the distance gone. As to courses, some authorities recommend their avoidance wherever possible. This does not seem to be necessary, as courses when not astronomical, should at least indicate the relation of all lines within the description one to another, and if the Surveyor has carefully measured an angle, why not give his client the benefit of the information as to what that angle is?

At the suggestion of the Master of Titles, Surveyors in Toronto and vicinity when making use of bearings usually indicate the governing lines for the same, as that makes it clear that, while these bearings are not necessarily astronomical, they do indicate the relation of the courses of the several lines mentioned.

Years ago the repeated calculation of courses aroused in my office a feeling that these repetitions could be avoided, and a table

was compiled which gives the inclination of lines to each other for every inch of perpendicular from 1 to 24, and for length of from 50′ to 200′. A copy of this table is submitted, and a little practice will enable anyone to use it without risk, not only for the territory covered by the table itself, but for parts or multiples of the same.

We believe that technical accuracy may sometimes be disregarded in the interests of practical advantage, and the principle is sometimes applied in describing properties where existing boundaries are intended to govern, no matter how irregular. Take, for instance, the division line between two parties owning a pair of semi-detached dwelling houses. It frequently happens that the party wall is not parallel to the other side boundary, nor does the fence line between the rear premises run on a course similar to either of the other courses. At the same time, the purchaser and vendor expect the bent line to become the boundary. Should a fire occur and the existing boundaries be entirely swept away, it is usually in the interest of the owners of both parts that the line for the new building should be a straight one, and therefore we believe that in some cases a description following along the centre line of partition wall and along the existing fence between the rear premises, without indicating courses, is admissable so long as the front and rear extremities of the division line are carefully located with regard to lot lines. This view would doubtless be considered rank heresy by theorists, but the practical Surveyor and practical owner usually agree that it is better for all concerned to provide for contingencies in that way.

The question as to party walls has been so thoroughly dealt with in previous papers before this Association that slight reference only will serve at this time. A very usual form of description follows the centre line of partition wall and thus conveys the fee up to that fixed line, but in only rare instances is any provision made that the owner of each of the adjoining houses is entitled to the undisturbed use of that part of the partition wall not included within his property.

"More or less" is a much discussed expression and the average conveyancer abuses it, while even careful Surveyors are sometimes guilty of sins of omission and commission in respect of it. The courts have settled that distances to fixed visible boundaries or limits that can with accuracy be determined become "more or less" even without the use of the actual words. This being the case, the writer frequently omits the words when he is satisfied as to the actual distance, as a description presents to the layman a much more definite appearance and is not weakened by such omission.

[*This Association is not responsible as a body for the opinions expressed in its Papers by Authors.*]

SURVEYORS AND THE LABOR QUESTION.

BY J. M'CORMACK WATSON, ORILLIA.

While not feeling equal to the task of writing a paper that would be worthy of a place in the published report of the Association, I would like to draw attention to the conditions which at present obtain in relation to contract surveys, in the hope that discussion on the subject may suggest some remedy.

Of paramount importance in this regard is the labor problem, and in this the surveyor, whose work is usually far from a base of supply of either men or provisions, occupies a peculiarly disadvantageous position, and is indeed practically at the mercy of his men. It is a well-known fact that to carry out surveys in the northern parts of the Province with the greatest economy and safety, and with the smallest risk of failure, only seasoned bushmen should be employed, men capable of traversing the long and more or less dangerous water routes leading to the locality in which the work is situate, and having sufficient intelligence and experience in line work to be able to appreciate the difference between cutting a survey line and a wagon road. Owing to the great demand, due to rapid development along various lines requiring their services, this class of men is becoming yearly more difficult to obtain, and when obtained at a yearly increasing wage, are more difficult still to keep, as knowing the importance of their services and the advantage they hold over an employer in a remote district, their demands are often impudent and unreasonable, taking no account of the terms on which they were originally engaged, but using their present position to the full limit of advantage. I do not mean, of course, to state that all men of the class referred to are of this make-up, but one or two of the extreme type will usually find a place on a party, and being expert agitators, soon have things in a disorganized state; and should there be one or two others who have sufficient moral courage to stand out, they stand alone and do not at all interfere with the agitators' game, who has effectually tied up the work.

Flowing directly or indirectly from causes of the above nature, we have suffered a financial loss during the past two sea-

sons exceeding three thousand dollars, have been exposed to the rigors of a winter snowshoe trip of more than two hundred miles, when the travelling conditions were almost at the limit of badness, and it was easier to pack the outfit on a tump line than to attempt to haul it on a toboggan, with the attendant evils of frozen feet for some of the men leading to amputations and threatened lawsuits for recovery of damages; canoes and camp outfit, which it was impossible to transport on a winter trip, left in the woods; a complete camp outfit and instruments destroyed by fire, and a large cache of provisions, upon which much labor had been spent in transport, carried away by bears. Against these things, due almost entirely to prostituted labor conditions, we are practically without a remedy, as we have found that no matter how carefully a contract may be drawn and executed, the laborer seeking to recover wages is invariably favored by the courts, and seldom has difficulty in obtaining a judgment favorable to his case, however flagrantly he may have violated his contract. Still further loss than that mentioned above would have resulted but for the precautions taken at the outset of carrying a supply of provisions largely in excess of what should have been required in carrying out the work, thus obviating the necessity of making additional trips for supplies.

Now, sir, the question I would like to hear discussed is whether surveyors, owing to the peculiar and important nature of their work and the unusual conditions under which they are compelled to operate, are entitled to special protection in labor matters; and whether legislation along this line could be made practical and effective, or must we resort to the alternative of making a request for higher rates on contract surveys to enable us to cope with the present situation and relieve us from the chagrin of finding at the end of a season of hard work, the balance staring at us from the wrong side of the ledger?

DISCUSSION.

The President—You have heard this paper, gentlemen. It opens up a question I think that all of us who have been out on the field have been confronted with. Personally, I am sure that no legislation can be made to cover the case. It will always remain, I think, with the surveyor's judgment. In 1880 or 1881 something of this sort occurred with some of the surveying parties in the West. They had trouble with the men, and the Department of

the Interior had forms printed for engaging the men, and the men had to sign these before witnesses and all that sort of thing. I don't think I ever had any signed myself by any of my men, but it was undoubtedly more or less of a deterrent to the men. They knew they had signed something, and that on the strength of that they were liable to prosecution. They were liable without that, of course, but they felt that something had been signed, and the surveyor had a better hold on them than otherwise; but in the long run it is altogether a matter of the surveyor using his own judgment in selecting his men in the first place, and in handling them when they are under canvas. I don't think the Government will make special laws for surveyors for protecting them from the men; in fact, I don't think any laws could be made which would be of much use. I would be glad to hear the experience of some of the surveyors. You have all been out on the field, and you can tell how you got along with them, whether you suffered by men deserting or running away with the provisions and other things, and so on.

Mr. Niven—I have listened to this paper with a good deal of interest. As far as my own experience has gone, I have never had a great deal of trouble with my men. I have had more trouble, I think, this year than I had in my whole life. They were hired generally at $2 a day, and going down the Missanabie River we came in contact with some men who had contracts for taking supplies to the Transcontinental Railway. When they would see a good looking man in my party they would say, "What wages are you getting? $2. Well, come along with me, and I will give you $2.50;" and some of them went. Well, this disorganized the party to some extent, and the others who remained felt they had the cue in their own hands to some extent, and they didn't care whether they worked much or not, and they would go off too if they could. I paid the way of most of these men up there, and I had to furnish them with moccasins and clothing, and some of the men got into me perhaps $15 or $20 apiece before they did anything, and some of them went away owing me those amounts. Then in the matter of wages, I had to pay this year all the way from $45 to $75 a month, some of them $2.50 and $3 a day. I had to do it to get them to do anything. I don't know how the matter could be remedied. I am afraid, as Dr. Klotz has said, there is no remedy for it, and it must be left with the surveyor. I try to get the best men to start with, and do the best I can with them afterwards, but there is no doubt the past season opened the way for more of that kind of work than ever before. As I said, it was the worst in my whole experience.

Mr. Fawcett—Twenty or twenty-five years ago you could get as many parties as you wanted of first-class men, who would engage

with you and stay with you till the end of the season. But as conditions change, it is more difficult to get good men. The good men are going off in other lines. During last season I had little trouble in securing good men at Saskatoon and places east of that. There seemed to be generally a good supply of fairly good men ready to engage in survey work at reasonable wages. Last spring, when I made up my party, there were plenty of men, some of them good looking men; some of them had been on surveys before. A good many men applied who had no experience of surveying, and of course I never engaged that kind of men. I usually select men from their appearance when they apply to me for work, and I very seldom make a mistake in that line. I got some bush men who had been engaged in bush work in Ontario, as my work was in the woods where the timber was very heavy. It was just as heavy as in Algoma. At the end of a month three of the best of my men wanted to leave. I had taken them a hundred miles over rough country, and as they were good men, I compromised with them. I said, now, if you will stay with me until the end of the season I will give you a bonus of $25 besides the wages which I agreed to give you. I had engaged them at $35 a month. Well, they stayed for about two weeks, and the weather got very warm, and they worked very hard, and they were going to leave again and they thought they were very much abused when I wouldn't give them any extra pay, just giving them the $35 a month. A few weeks after that I had a good man or two left, and they wanted to hold me up. Of course I had heard something of what had been discussed in their tent, and I found out they intended to hold me up for $10 a month, and when they applied for leave of absence they got it. I gave them their cheques and they left the next morning and I was left with a very poor party in a very heavy tract of country. I had to send my teamster out and scurry the country for men, and he was successful in securing some half-breeds who remained with me until the end of the season and did pretty good work. So this is a serious problem for surveyors now. Good men are not available for that kind of work. They can make more money at something else, so that the surveyors have to fall back on what is left. In undertaking a contract now, we hardly know what is before us. The time was when a surveyor could estimate to a small item what his survey would cost and what his expenses would be, but now it is a very difficult matter.

The President—It seems to me if the Government would pay more, so that the surveyor could pay a better wage, he could then compete with other employers. That, to me, seems the easiest way out of the difficulty. I think it would be wise to state to the Government and those who employ surveyors, what the facts are. Mr. Niven spoke of this contractor for the Transcontinental paying

$2.50, and that is an instance. The surveyor ought to be paid a sufficient amount, so that he can compete. I think the same thing would apply to the men who are paid direct by the Government on the Transcontinental. The engineers have surveyors I suppose. Here are two men working for the Government, and one is getting so much more than the other, which certainly is not fair.

As far as making a contract and forcing them to stay with you, you cannot get any Legislature to do that. That seems utterly impracticable. The only way out of the difficulty is to place the surveyor in a position where he can pay the wages and compete with other employers.

Mr. Beatty—I think the question of labor in connection with surveying is assuming alarming proportions. Now, I haven't been very long engaged in survey work for the Government, but taking the last five years, it seems to me that one year after another the trouble is increasing in geometric proportion. Our wages to-day are more than double what they were. I know ten years ago you could employ good men for $30 a month, and now you have got to pay $45 to $75, as was mentioned by one of the surveyors present. The difficulty is, the rate of remuneration to the surveyor is not equal to the employes. Now, so long as we put a low price on our surveys, you can guarantee you will get a low price. There is no doubt the remuneration should be raised. Now, with reference to men leaving last year, in giving my own experience, I employed all my men under written contract. Now that is something that has to be very carefully drawn up. The form of the contract has got to be very strongly worded in order to make it worth the paper it is written on. Once a man kicks, the sooner he leaves the job the better. I think you can put in a protective clause. The clause I had last year was, in the event of their leaving before the completion of a certain time—not before the completion of the survey, because the courts have given a decision that a contract in that way is not legal, because they say the survey might never be completed—but if you specify an outside limit, say four and a half months or five months, in the event of their leaving before that term to take a certain proportion off their wages; and in addition you can make them pay any expenses that you may be put to in order to replace them. I may tell the members present that worked out to my satisfaction. As a matter of fact, I had four men employed for $50 a month, and in the contract it specified in the event of their leaving I could deduct one-third from their wages, and take any expenses I would be put to in replacing them, and at the end of a month they left. Well, they threatened the law, but I told them to go ahead, that I would as soon spend the winter in law as losing my money in the summer. I don't think you can keep men on the survey if they want to go, but something

can be done in this way. I am glad that the labor question has been brought up before the meeting, because it is going to be a very serious thing. I think we are going to have more trouble in the future than in the past, and the remuneration of the surveyor is not at all in proportion to the wages he has to pay, and I hope something can be done in this respect.

Mr. Fitzgerald—Has the opinion of a good, sound lawyer been got on this agreement? I understand Mr. Watson had some agreement, and the men left him. I understand that the men sued him and the courts gave judgment in favor of the men, and he had to pay them to the day they left the party. I don't know the wording of the agreement, of course.

Mr. Beatty—You have to be very careful as to the form of the agreement. When these four men left me, I wouldn't settle at all. I said, "I will give you enough money to take you home and you can settle with my solicitors." That is the answer they got, and they went out on that basis, and they started their solicitor after me, but I paid no attention to the solicitor's letters and referred them to my solicitor. He showed me a few weak points in the agreement. Although he isn't on the top rung, still he is good legal advice, and he said it would depend on what judge it came before. He said it might come up in the Division Court, as the money involved was usually small; but he said if it came before a judge who would accept the contract, there was not a judge in the country who would not uphold it. When it comes before a High Court it becomes a question of law, but he said in the lower courts it would depend on the view the judge took of it. I think you can get an agreement that will hold to a very great extent.

Mr. Niven—I drew up an agreement once modelled after the one in the Dominion Lands Manual, but I couldn't get the men to sign it. They said they wouldn't sign any agreement, and that was the beginning and the end of it. My experience is, if you get a troublesome man, what you call a kicker, in your party, the sooner you get him out of the party the better, because he will give you trouble all along the line and he will affect the others as well. When a man begins to grumble and find fault, if it is at all possible I would let him go.

Mr. Beatty—The Government in the surveys through the north country use an agreement which the men have to sign, agreeing to work for five months under certain conditions, and if they break that agreement they don't get a settlement.

Mr. Fawcett—They have a special Act.

Mr. Fitzgerald—Mr. President and gentlemen, I have put my

ideas on this subject in writing. I couldn't make a speech if I tried.

The President—This is a good paper, and I think the suggestion that a memorial should be presented to the Government or to the Minister of Lands, Forests and Mines, should be carried out. I am sure they would recognize the justice of the plea which has been put forward. He has given figures which I think cannot be gainsaid, and I would be glad if one of the members would prepare a resolution in this matter.

Mr. Whitson—In preparing my paper last year, I took particular interest in noting the prices paid to surveyors during the last hundred years. I found up till 1818 the price paid was about two cents per acre; from 1818 it was three cents per acre; in 1837 it reached five cents, and in 1857 seven cents, where it remained till 1900. At that time, at the recommendation of Mr. Kirkpatrick, it was raised to ten cents over the height of land and from seven to eight cents on this side of the height of land, where it remained till last season. While the price per acre was not apparently raised last season, it was, in fact, raised in surveying the larger Townships, which were on the new nine-mile system. The six-mile system was seven cents per acre. I made a calculation, and I think that is a little less than $30 per mile, and in the new nine-mile Townships the price is somewhere from $61 to $64 per mile, and that is quite an advance on the old rate. The price paid for base lines in the early days was $36 per mile, and then raised to $40, and then to $45. I think from the meridian line to James Bay the price was $50.

Mr. Niven—Fifty-five dollars.

Mr. Whitson—It has remained at that. I think the price of $55 for base lines is ridiculously low. Certainly eight cents per acre on this side the height of land is very low.

Mr. Kirkpatrick—It seems to resolve itself into this: If you have a good party of men and you have a nine-mile-square Township, you have a very good job, and you can make money at ten cents an acre, because there are less lines to run relatively than in the six-mile Townships. We have arranged that by extending the length of the concessions, and the side roads naturally come further apart than in a six-mile Township, and consequently there is less mileage. The only difference is, he has got more posts to plant, and I don't think the planting of posts figures much in the cost. When we were re-surveying a double-front Township where we had three posts to plant every thirty chains, we chainmen had to make the posts, plant them, do the chaining, and carry the lunch for the party. Well, I didn't suffer from it, although we had to work pretty hard. We got our board out of it. I didn't

grumble, for I was laying the foundation for what I was going to do; but some young men now want to come in on top. I said to some of them, "Did you ever see a chain?" "No." "Well," I said, "I wouldn't take you if you offered me $100." The chain man can wreck the party, for if he breaks the chain and loses his tally every now and then, how is the surveyor coming out? The planting of the extra number of posts doesn't add much to the cost. Of course we have a good lot of six-mile Townships yet, and the difficulty is to give more than two Townships to one surveyor, because there are so many surveyors wanting them. If you have got a good set of men, it doesn't take you five months to do it. You can do it in about three months. Then the trouble is, the surveyor comes out and his men miss a whole summer's work. I have great sympathy with the men. They ought to have a whole summer's work. Of course, the surveyors are expected to get in their returns as soon as possible, but some of them throw over this work and go at their own private work. Well, humanly speaking, you cannot blame them, but officially we do, because we want the returns in as quickly as possible.

I think if the surveyors would get together unanimously and draw up a memorial to the Minister on the lines of Mr. Fitzgerald's suggestion, it might have some effect. I assure you I will do what I can when it comes before me. The surveyors now should make real good work on their surveys. It isn't like olden times, in 1809 or 1810, when they just sent out a man with a compass to run a line. Half the time we never got returns of these old surveys, and we don't know which lines were run and which were not, and we don't know where some Township boundaries are. We had a beautiful case before us the other day, when a question of some Townships came up. About seventy years ago two surveyors had gone out and each of them had laid out a Township, but there was only one Township laid out. We don't want any of these mistakes now, as we try to make the instructions as clear and definite as possible. We have introduced the system of planting iron posts, because we want to perpetuate our surveys. We plant posts at the four corners of the six-mile Townships, and half way on each of the boundaries, so that we have eight iron monuments to each Township in the six-mile square system. These posts are carefully prepared and painted, and the surveyor is instructed to plant them so that there will be no difficulty in case a fire should pass over the country. What we want to do is to make good work, so that it will be an honor to the profession and an honor to the Department.

Now, there is no use one or two signing this memorial. It is an easy thing to figure out the cost and put it clearly, as Mr. Fitzgerald has put it. I remember last year speaking of the cost of surveying and the cost of pork and flour, and the difference now

in the way that surveyors had to fit out their party. I was surprised in going out to these shanties a couple of years ago. I wouldn't want better meals; just as good a meal as you can get at home—cakes, pies and apple sauce, and all sorts of dainties. The surveyors have to take these things along, and it costs money. In the old days it was pork and bread and bread and pork and tea. I think the Association have it in their own hands if they put in a strong and not too extravagant an application.

Mr. Fitzgerald—With reference to what Mr. Whitson and Mr. Kirkpatrick said as to the nine-mile Townships, I think they are a little out in their calculation. I have had a little experience in those Townships. The lines are a good deal farther apart, but the work has to be done more carefully, and you have to take more frequent observations, and you have to move camp oftener and you have longer walks, and taking the whole thing into consideration, there is not much difference between the six-mile and the nine-mile Townships. You must have two gangs, two men chaining and one making the posts. Taking the whole cost into consideration, there is not much difference.

Mr. Bolton—It has been my lot to be working up in Cobalt District, beside Mr. Fitzgerald, and I find the further you go inland to make a survey the more difficult it is to get men, because, first of all, you have to get a man who can handle a canoe, and you must have a man who can handle an axe. In the olden days the work was near at hand, and we could go straight to our survey by the railroad, but now it is different, and it costs more. We have all had difficulties with our men, and we have to pay higher prices for everything we use. I am willing to support any memorial that may be brought before the Government.

Mr. Newman—I had two of those nine-mile Townships north of the Abitibi River, and it took me seventeen days from the time I left home until I got to my work. I paid my men from $45 to $75 per month, and when I came out my profits were very limited. It seems to me that ten cents an acre in that district, considering the time it takes us to get there, is very small.

MEMORIAL TO SIR WILFRID LAURIER.

To the Right Honourable Sir Wilfrid Laurier, G.C.M.G., Premier:

Toronto, Ont., March 7th, 1907.

Sir, The Association of Ontario Land Surveyors at their annual meeting last week unanimously resolved:

That the time has arrived when Canada must begin, as a national undertaking, a geodetic or trigonometric survey of the Dominion. The want of such a survey, with its accompanying well determined geographic positions, has been long recognized by all members of the Association. The ever greater accuracy aimed at by the profession does not nor can it have its full value until the work can be connected with points that are definitely fixed in position upon the surface of the earth. With our rapidly developing country there is at the moment no need greater than that of accurate topographic maps. Canada is the only civilized country that has not yet fully recognized this very important principle, viz.: that the progress of a country is intimately bound up with accurate maps.

From purely material considerations it is true economy to spend money wisely in the direction of a geodetic survey. The same would, it is expected, be implemented by detail surveys made by the various provinces so that the resulting maps would be available for railway, geological, municipal, drainage, irrigation, forestation, navigation, transportation purposes, in fact for all the needs of man.

That the work of primary triangulation, which would necessarily cover the older Provinces first, must be undertaken by the Federal Government to assure homogeneity throughout Canada.

And finally, that the Dominion Government be hereby requested to carry forward with all possible speed, as the circumstances permit, a trigonometric and geodetic survey of Canada in the interest of the people and to further the progress of the whole country.

Respectfully submitted,

The Association of Ontario Land Surveyors.

KILLALY GAMBLE,

Secretary.

MEMORIAL TO THE MINISTER OF LANDS, FORESTS AND MINES FOR THE PROVINCE OF ONTARIO.

To the Hon. Frank Cochrane, Minister of Lands, Forests and Mines for the Province of Ontario:

The Memorial of the Association of Ontario Land Surveyors in Council assembled respectfully showeth that your memorialists having considered the changed conditions under which survey work, including base and meridian lines and township sub-divisions is undertaken, respectfully submit that a very material increase in the rates paid during the past few years should be made for all classes of work to meet those conditions.

Your memorialists beg to submit a quotation from the remarks made at the present meeting of the Association by Mr. Fitzgerald, one of the members thereof:—"I wish to say something on the subject now up for discussion. Any of us who have ever worked in the far northern part of the Province, know that besides the great mineral area, besides Cobalt and Sudbury and the dozens of Cobalts and Sudburys yet undiscovered, there are there, millions of acres of as fine land as was ever turned up by a ploughshare. We know it is not a prairie, but better than a prairie; there will be no fuel famines there, such as have been experienced in the great North-west this present winter, and such as I am sorry to say have put many of the hardy settlers of the prairie to their long last sleep. No, gentlemen, this country is timbered with vast quantities of valuable woods, woods that are fast disappearing and becoming more and more expensive in the older parts of the Province. The Grand Trunk Pacific will in a year or two have cut this great clay belt in two; prosperous cities, towns and villages must and will at once spring up. This country is destined to be one of the richest agricultural areas in Canada, and one of the greatest producers and manufacturers of lumber, pulp, paper and all other wooden products in the world. The power is there to turn the wheels to run the mills and factories. To give an instance, in one township alone surveyed by me last season, there can be developed fully 1,500 horse power. Capitalize this at $15.00 per horse power—the lowest price quoted by the Hydro-Electric Power Commission—and you have the figure of $225,000.00, the value for one year of one river in one township. Now, gentlemen, we know that

all this country will be settled in the near future. We also know that this great country has got to be surveyed within the next few years and that we, or those who succeed us, will have to do that work. Let us then compare the position of Surveyors to-day with that of fifteen years ago. I am going to speak entirely on the conditions appertaining to township sub-division work, and I have no doubt these conditions apply equally, or with greater force, to base and outline work. My friends, Mr. Niven, Mr. Speight and Mr. Patten will, I think, bear me out on that. I may say I have spent the past twenty-five years almost exclusively on township surveys in the North-west Territories, Manitoba and Ontario; for the past three seasons I have been engaged on township work in Northern Ontario. Fifteen years ago Surveyors in Ontario were allowed a flat rate of seven cents per acre; to-day they are allowed a flat rate of ten cents per acre. What I want to show, gentlemen, is that the rate of seven cents allowed fifteen years ago is just about equal to fourteen cents, twice that figure—and which is the figure I claim should be allowed on township sub-division contracts to-day. We know that fifteen years ago good canoe and bushmen could be had at from $20 to $26 per month—better men and more amenable to discipline than you can get to-day at from $52 to $65 per month—the figures I had to pay during the past season. Provisions of all kinds, especially bacon—the chief commodity—could be bought for just half the price of what it costs to-day. In those days it very seldom took more than a few days, or a week, for the Surveyor to reach the scene of his operations—second-hand canoes or any old kind of bark canoes would do for the trip. To-day a fleet of new Peterborough canoes—or good sound wooden canoes at any rate, have to be supplied, costing all the way from three to four hundred dollars. Fifteen years ago if a gang of men jumped, it was an easy matter to replace them in a few days, owing to the Surveyor's proximity to civilization and base of supply. To-day if a gang jumps, it is a matter of throwing up the contract and suffering a loss of thousands of dollars. This season I surveyed about 70,000 acres in Northern Algoma. I was three weeks getting in to work and ten days coming out—more than a month in all—and I tell you candidly, gentlemen, that although I had what may be called good luck, I made no money, barely enough to live on. Now, when we can show that the wages paid to men to-day are double, or more than double, what they were fifteen years ago, and besides that you don't get nearly as good men, and you have to feed them better, and when we can show that the cost of provisions in that time has nearly doubled, and that owing to the length of time taken in getting in and out nearly twice the time is consumed in connection with the work; then, gentlemen,

taking everything into consideration, if seven cents per acre was a fair wage fifteen years ago, and I claim it was only a fair wage, is double that figure, fourteen cents per acre, more than a fair wage to-day? That is the question.

"Another question that must be taken into consideration is this. A surveyor who undertakes this class of work, must depend on it for a living. Suppose he is only three or four months in the field and seven or eight weeks getting out his returns—say five or six months in all—this debars him from accepting any permanent position. Nearly all the surveys made by private parties, corporations or municipalities, are made during the summer, the very season the Surveyor who accepts Government work is absent, and should he fail to make something out of his contract he is left without anything to tide him over the winter. It is impossible for a Surveyor to perform Government work and expect that he will retain any profitable share of his private or municipal practice. The great risk a Surveyor takes who goes back a couple of hundred miles to do work of this kind must also be taken into consideration —he is completely cut off from civilization and medical assistance and practically takes his life in his hands. Suppose for instance a Surveyor breaks his leg, this incapacitates him as a Surveyor for the rest of his life. Suppose he is struck down with blood-poisoning, appendicitis, cystitis or any other malignant form of disease where immediate medical assistance is imperative—what is the consequence? The consequence is he meets death at his post, like the late Wm. Bell, of Pembroke, and like many another surveyor has in the past. I feel confident that if this matter is taken up in the right spirit and the facts fully laid before the Hon., the Minister of Lands, Forests and Mines, and his colleagues, and our co-surveyors in the Surveys Office, that we will get a substantial increase. I do not think that the Province or the Government of the Province expects its servants to work for a mere pittance. Surveyors have to spend three or four years at College acquiring a technical and scientific education, and at least three or four seasons in the field before they are qualified to undertake this class of work; the work itself as we all know is about the hardest and most wearing that a man can undertake. Surveyors not only require to be keen, educated and practical men, but they must also be rugged and physically robust—we have to put up for five or six months in the year with all kinds of hardships, flies, heat, cold, rain and the rest of it."

Mr. Watson, O.L.S., writing from Orillia to the Secretary of our Association on the 15th February, 1907, says: "I would like to draw attention to the conditions which at present obtain in rela-

tion to contract surveys, in the hope that discussion on the subject may suggest some remedy.

"Of paramount importance in this regard is the labour problem, and in this the Surveyor, whose work is usually far from a base of supply of either men or provisions, occupies a peculiarly disadvantageous position and is indeed practically at the mercy of his men. It is a well-known fact that to carry out surveys in the northern parts of the Province with the greatest economy and safety and with the smallest risk of failure, only seasoned bushmen should be employed, men capable of traversing the long and more or less dangerous water routes leading to the locality in which the work is situate, and having sufficient intelligence and experience in line work to be able to appreciate the difference between cutting a survey line and a wagon road. Owing to the great demand, due to rapid development along various lines requiring their services, this class of men is becoming yearly more difficult to obtain, and when obtained at a yearly increasing wage, are more difficult still to keep, as knowing the importance of their services and the advantage they hold over an employer in a remote district, their demands are often impudent and unreasonable, taking no account of the terms on which they were originally engaged, but using their present position to the full limit of advantage. I do not mean, of course, to state that all men of the class referred to are of this make-up, but one or two of the extreme type will usually find a place on a party, and being expert agitators, soon have things in a disorganized state; and should there be one or two others who have sufficient moral courage to stand out, they stand alone and do not at all interfere with the agitators' game, who have effectually tied up the work.

"Flowing directly or indirectly from causes of the above nature, we have suffered a financial loss during the past two seasons exceeding three thousand dollars; have been exposed to the rigors of a winter snowshoe trip of more than two hundred miles when the travelling conditions were almost at the limit of badness, and it was easier to pack the outfit on a tump line than to attempt to haul it on a toboggan, with the attendant evils of frozen feet for some of the men, leading to amputations and threatened lawsuits for recovery of damages; canoe and camp outfit which it was impossible to transport on a winter trip, left in the woods; a complete camp outfit and instruments destroyed by fire, and a large cache of provisions, upon which much labor had been spent in transport, carried away by bears. Against these things, due almost entirely to prostituted labour conditions, we are practically without a remedy, as we have found that no matter how carefully a contract may be drawn and executed, the labourer seeking to

recover wages is invariably favoured by the courts and seldom has difficulty in obtaining a judgment favourable to his case, however flagrantly he may have violated his contract. Still further loss than mentioned above would have resulted but for the precautions taken at the outset of carrying a supply of provisions largely in excess of what should have been required in carrying out the work, thus obviating the necessity of making additional trips for supplies.

"Now, sir, the question I would like to hear discussed is whether Surveyors, owing to the peculiar and important nature of their work and the unusual conditions under which they are compelled to operate, are entitled to special protection in labour matters; and whether legislation along this line could be made practical and effective; or must we resort to the alternative of making a request for higher rates on contract surveys to enable us to cope with the present situation and relieve us from the chagrin of finding at the end of a season of hard work the balance staring at us from the wrong side of the ledger?"

Your memorialists submit for your consideration the following scale of prices as a fair rate based upon cost of labour, camp outfit and supplies at the present time, and respectfully request you to give effect to the same:

For six mile townships south of and adjacent to the height of land, ten cents per acre and $40.00 per mile for all boundaries run under the contract.

For six mile townships north of the height of land, fourteen cents per acre and $50.00 per mile for all boundaries run under the contract.

For nine mile townships north of the height of land, twelve cents per acre and $50.00 per mile for all boundaries run under the contract.

For base and meridian lines, $75.00 per mile.

For day work, $10.00 per day.

Your memorialists therefore hope that you will favourably consider their request and as in duty bound they will ever pray.

Dated at Toronto, this 28th day of February, 1907.

KILLALY GAMBLE, Secretary.

OTTO KLOTZ, President.

O. L. S. PRELIMINARY EXAMINATIONS, FEBRUARY, 1907.

PRELIMINARY ENGLISH GRAMMAR.

1. How is the possessive case formed in English?

2. Enumerate the indefinite pronouns.

3. Give the plurals of the following nouns: beau, species, cherub, bandit, miasma, series, genius, appendix, fungus, chimney, axis.

4. What modification do verbs admit of?

5. What are defective verbs? Give instances of those which are in common use.

6. In the sentence "He talks like a fool," what part of speech is "like" and how is it qualified?

7. Into how many classes are adjectives divided? Name them.

8. From what source is the grammatical framework of the English language principally derived?

9. The historical development of the English language has been divided into five periods. What are they?

PRELIMINARY TRIGONOMETRY.

1. Express $\frac{5}{18}$ of a right-angle in circular measure; also in degrees and decimals of a degree, and in grades and decimals.

2. There are three angles; the circular measure of the first exceeds that of the second by $\frac{11}{10}$. The sum of the second and third is thirty grades; the sum of the first and second is thirty-six degrees. Find the angles.

3. Prove that $\text{Sin.}\ (-A) = -\text{Sin}\ A$; $\text{Cos}\ (-A) = \text{Cos}\ A$; also
$\text{Tan.}\ (-A) = -\text{Tan}\ A$ and $\text{Cot}\ (-A) = -\text{Cot}\ A$
$\text{Sec.}\ (-A) = \text{Sec}\ A$ and $\text{Cosec}\ (-A) = -\text{Cosec}\ A$.

4. Prove $\text{Sin } 2A = 2 \text{ Sin } A \text{ Cos } A$,
and $\text{Cos } 2A = \text{Cos}^2 A - \text{Sin}^2 A = 1 - 2 \text{ Sin}^2 A = 2 \text{ Cos}^2 A - 1$.

5. From a station B at the base of a mountain its summit A is seen at an elevation of 60°; after walking one mile towards the summit up a plain making an angle of 30° with the horizon to another station C the angle B C A is found to be 135°. Find the height of the mountain.

6. In a right angled spherical triangle the hypotenuse is 75° 20′ and a side 64° 10′; find the other parts.

7. Find the angles of the spherical triangle whose three sides are 62° 54′, 125° 20′, and 131° 30′.

8. If $A = 90°$, $B = 60°$, $C = 30°$, $D = 45°$,
Show that $\text{Sin } B \text{ Cos } C + \text{Cos } B \text{ Sin } C = \text{Sin } A$.
Also $\text{Cos}^2 D - \text{Sin}^2 D = \text{Cos } A$.

PRELIMINARY ALGEBRA AND LOGARITHMS.

1. Simplify the expressions: —

$$\frac{x^4 + x^2y^2}{x^4 - y^4}, \quad \frac{x^2 + 3x + 2}{x^2 + x - 2}, \quad \frac{x - a}{\frac{1}{a} - \frac{1}{b}}, \quad \frac{a - b}{1 - \frac{a}{x}}.$$

2. Extract the cube root of:—
$8x^6 - 36cx^5 + 102c^2x^4 - 171c^3x^3 + 204c^4x^2 - 144c^5x + 64c^6$.

3. Solve the equations:—

(a) $$\frac{x - 6y}{2} - \frac{x - y}{2} = 2\tfrac{1}{2}$$
$$\frac{x + y}{2} + \frac{x - y}{2} = 4\tfrac{1}{6}$$

(b) If 3 be added to the numerator of a certain fraction its value will be $\frac{1}{3}$, and if 1 be subtracted from the denominator its value will be $\frac{1}{5}$: What is the fraction?

4. Solve the equations:—
$ax^2 + bx + c = 0$.
$3x^2 - 53x + 34 - 0$.

LOGARITHMS.

5. Prove that log. $a \times b = \log. a + \log. b$.

Prove that log. $\frac{a}{b} = \log. a - \log. b$.

Prove that log. $a^n = n \log. a$.

6. Find by logarithms the value of:—

$$(363.948)^{\frac{3}{4}} \text{ and } (1.73296)$$

7. Indicate the solution by logarithms:—

$$\sqrt[4]{\frac{a^5bx^3}{c^5m^3x}} \quad , \quad \sqrt[3]{\frac{a^2b}{c^2d^2}}$$

8. Find numbers corresponding to the following logs.:—

$$4.653213\,; \quad \bar{2}.698970\,; \quad \bar{3}.720159.$$

9. Find the angle of which 9.88724 is the cos.
Find the angle of which 9.778744 is the sin.
Find the angle of which 9.724835 is the cot.
Find the angle of which 9.634251 is the tan.

PRELIMINARY EUCLID.

Maximum 100: Minimum 60.

1. Define: straight line, parallel straight lines, axiom, theorem, corollary.

2. If two sides and the contained angle of one triangle be equal to two sides and the contained angle of another triangle, the two triangles shall be equal in every respect: that is,

(1) The third sides shall be equal.
(2) The remaining angles of the one triangle shall be equal to the remaining angles of the other triangle.
(3) The areas of the two triangles shall be equal.

3. If one side of a triangle be produced, the exterior angle shall be greater than either of the interior opposite angles.

4. If a straight line be divided internally into any two segments, the square of the straight line is equal to the square on the two segments increased by twice the rectangle contained by the segments.

5. If two circles touch one another at any point, externally, the straight line which joins their centres shall pass through that point.

6. To inscribe a circle in a given triangle.

MENSURATION.

1. The circumference of a circle being given to find the diameter, or the diameter given to find circumference. Give rules. Diameter of a circle is 8,000 miles, find circumference.

2. A lawn measures 150 feet by 120 feet: find how many pieces of sod are required to cover it, each piece being 3 feet 4 inches by 1 foot 3 inches.

3. A bed of gravel 4 feet 6 inches in depth extends over the whole of a field of 3 acres 3 roods: find the value of the gravel at six pence per cubic yard.

4. A rectangular field is 440 yards long and 154 yards wide: find its areas in acres. Also find the areas of the portions into which it is divided by a straight line drawn from the middle point of one side to one of the opposite corners.

5. Find the cost of paving a street half a mile long and 47 feet broad, at the cost of seven pence half penny per square yard.

PRELIMINARY LINEAR DRAWING.

1. When it is shown on a plan that the representative fraction is 1-4752, what is the scale of the plan, reading chains?

2. Draw a scale for a plan where 90 feet is represented by 1 inch to read 5 feet; and print over it neatly—Scale, 90 feet to 1 inch.

3. Draw a parallelogram having its two sides 5 and 7 inches long and the acute angle 45°.

4. Describe a circle of three inches diameter and draw two tangents to the circle from a point 2 inches outside it. Show the construction.

5. Draw five lines parallel to one another and ¼ of an inch apart, one heavy, one medium, one very fine, one with single dots and one with chain dots.

6. On a base of four inches construct a right-angled triangle and inscribe in it a circle inking it in carefully.

PRELIMINARY GEOGRAPHY.

1. Give a statement of the leading railways of the Dominion of Canada, their routes and approximate dates of construction.

2. Draw an outline plan of the Province of Ontario, giving rivers, lakes and other boundaries.

3. Name the leading industries of the Province of Ontario and the facilities for carrying them on.

4. Draw an outline plan of the Hudson Bay, showing the principal rivers entering it and describe its valuable products and its prospective value as a commercial route.

5. Give a statement of the different climatic conditions of the Dominion of Canada, the cause of the same and the benefits.

6. Describe the source and drainage area and outlet of the Nelson River.

PRELIMINARY CANADIAN HISTORY.

Maximum 50; Minimum 25.

1. (a) Relate the principal events connected with the discovery of Canada.

   (b) Describe the character, customs, habits and physical characteristics of the principal Indian tribes of Canada.

   (c) Point out the regions inhabited by the Hurons, Algonquins and Iroquois respectively.

2. (a) Give some account of the endurance and self-sacrifice of the Jesuits in their efforts to Christianize the Indians.

   (b) With what discoveries are the names of Marquette, Joliet and La Salle identified?

(c) Outline the plan of the campaign which ended in the conquest of Canada.

3. (a) State and point out the causes that provoked the War of 1812-14.

(b) Write explanatory notes of the following battles: Queenston Heights, Lundy's Lane, Moravian Town, Chatauquay and Chrysler's Farm.

(c) What treaty brought this war to a close?

4. (a) Write explanatory notes on the following: Family Compact, Clergy Reserves Question, Canada Trade Act.

(b) Point out the causes of the Rebellion in Upper and Lower Canada.

(c) Sketch the principal events of the "Patriots' War."

5. (a) Describe from your own point of view the character of the following men: Sir Francis Bond Head, Papineau, William Lyon Mackenzie and Dr. Ralph.

(b) Explain the nature of Lord Durham's Report.

(c) State what is meant by Responsible Government.

6. Write explanatory notes on the following: Washington Treaty, Fenian Raids, Red River Rebellion, National Policy and North West Rebellion.

FINAL EXAMINATIONS.

FINAL GEOMETRY.

Maximum 150: Minimum 90.

1. Give the meaning of the following geometrical terms: superficies, right angle, rectilineal figure, scalene triangle, rhombus, rhomboid, gnomon, tangent, sector of a circle.

2. Describe a parallelogram equal to a given rectilineal figure and having an angle equal to a given rectilineal angle.

3. Prove that the three interior angles of every triangle are together equal to two right angles.

4. Inscribe an equilateral triangle in a given circle; trisect a right angle.

5. To divide a given straight line into two parts so that the rectangle contained under the whole and one of the parts shall be equal to the square on the other part.

6. The sum of the perpendiculars let fall from any point within an equilateral triangle will be equal to the perpendicular let fall from one of its angles upon the opposite side.

7. Upon a given straight line to describe a segment of a circle which shall contain an angle equal to a given rectilineal (acute) angle.

8. Prove that the opposite angles of a quadrilateral figure inscribed in a circle are together equal to two right angles.

9. Equiangular parallelograms have to one another the ratio which is compounded of the ratio of their sides.

10. If an angle of a triangle be bisected by a straight line which likewise cuts the base, the rectangle contained by the sides of the triangle is equal to the rectangle contained by the segments of the base together with the square on the straight line which bisects the angle.

FINAL ALGEBRA.

Maximum 100; Minimum 50.

1. Find the greatest common measure of:—

$$5a^4b^2 + 2a^3b^3 + ca^2 - 3a^2b^4 + bca \quad \text{and}$$
$$a^5 + 5a^3d - a^3b^2 + 5a^2bd.$$

2. Insert six mean proportionals between the numbers 3 and 384.

3. Find the cube root of:—

$$x^3 + 6x^2y + 12xy^2 + 3y^3 - 3x^2z - 12xyz - 12y^2z + 3xz^2 + 6yz^2 - z^3.$$

4. Solve
$$x^2 + xy = 77$$
$$xy + 2y^2 = 60$$

5. Two persons A and B start from two different points and travel towards each other. When they meet it appears that A had travelled 30 miles more than B. It also appears that it will take A four days to travel the road that B had come, and B nine days to travel the road that A had come. What was their distance apart when they set out?

6. One hundred stones being placed on the ground in a straight line at a distance of two yards from each other; how far will a person travel who shall bring them one by one to a basket placed 2 yards in rear of the first stone?

7. Show that $a^n - b^n$ is always divisible by $a - b$.

8. Two merchants sold the same kind of linen; the second sold three yards more than the first and together they received $35. The first said to the second, "I would have received $24 for the linen you sold;" the other replied, "I would have received $12.50 for yours." How many yards did each of them sell?

9. Find the number of round shot in a triangular pile in which each side of the base is composed of eight shot.

Give the formula.

10. Find the square root of: $\dfrac{a^2 + x^2}{a^2 - x^2}$

FINAL TRIGONOMETRY.

1. Prove that $\text{Tan}\ (A+B) = \dfrac{\text{Tan}\ A + \text{Tan}\ B}{1 - \text{Tan}\ A\ \text{Tan}\ B}$

2. To solve a triangle having given two sides and the included angle prove that $\text{Tan}\ \frac{1}{2}\ (B - C) = \dfrac{b-c}{b+c}\ \text{Cot}\ \dfrac{A}{2}$

3. Derive the formula :—

(a) $\text{Tan}\ \dfrac{A}{2} = \sqrt{\dfrac{(s-b)\,(s-c)}{s(s-a)}}$

(b) $\text{Sin}\ A = \dfrac{2}{bc}\sqrt{s(s-a)\ (s-b)\ (s-c)}$

4. A balloon is ascending uniformly and when it is one mile high the angle of depression of an object on the ground is found to be 35° 20′. Twenty minutes later the angle of depression is found to be 55° 40′. Find the rate of ascent of balloon.

SPHERICAL TRIGONOMETRY.

5. Derive the formula, $\text{Cos}\ a = \text{Cos}\ b\ \text{Cos}\ c + \text{Sin}\ b\ \text{Sin}\ c\ \text{Cos}\ A$.

Deduce from above the following :—

$$\text{Sin}\ \frac{A}{2} = \sqrt{\frac{\text{Sin}\ (s-b)\ \text{Sin}\ (s-c)}{\text{Sin}\ b\ \text{Sin}\ c}}$$

6. Derive the formula $\text{Sin}\ \dfrac{a}{2} = \sqrt{\dfrac{-\text{Cos}\ S\ \text{Cos}\ (S-A)}{\text{Sin}\ B\ \text{Sin}\ C}}$

And find b having given

$A = 38°\ 19'\ 18''$
$B = 48°\ \ 0'\ 10''$
$C = 121°\ \ 8'\ \ 6''$

7. Given $a = 70°\ 40'\ 18''$
$b = 63°\ 21'\ 27''$
$c = 59°\ 16'\ 23''$

Find the angle B and C.

MENSURATION AND DIVIDING OF LAND—FINAL.

1. Give the rules for finding the areas of,—

A triangle.
A quadrilateral.
A circle.

2. Find the area in acres of a quadrilateral, two of whose opposite sides are 500 links and 400 links, the other two 450 links and 350 links and the inclination of the diagonals, 80°.

3. The diameters of two concentric circles are equal to 19 and 43.5 feet; what is the area of the included ring.

4. Show how to find the area of any irregular polygon; also the area of any curvilineal figure.

5. Lay out 114, A. 2, r. 33.4, p. in a rectangle, the length to exceed the breadth by 15.10 chs.

6. The three sides of a triangle taken in order measure 15.10 and 13 chs.; divide it into two equal parts by a line parallel to the second side; what will be the length of the dividing line and its distance from place of beginning measured on the first side?

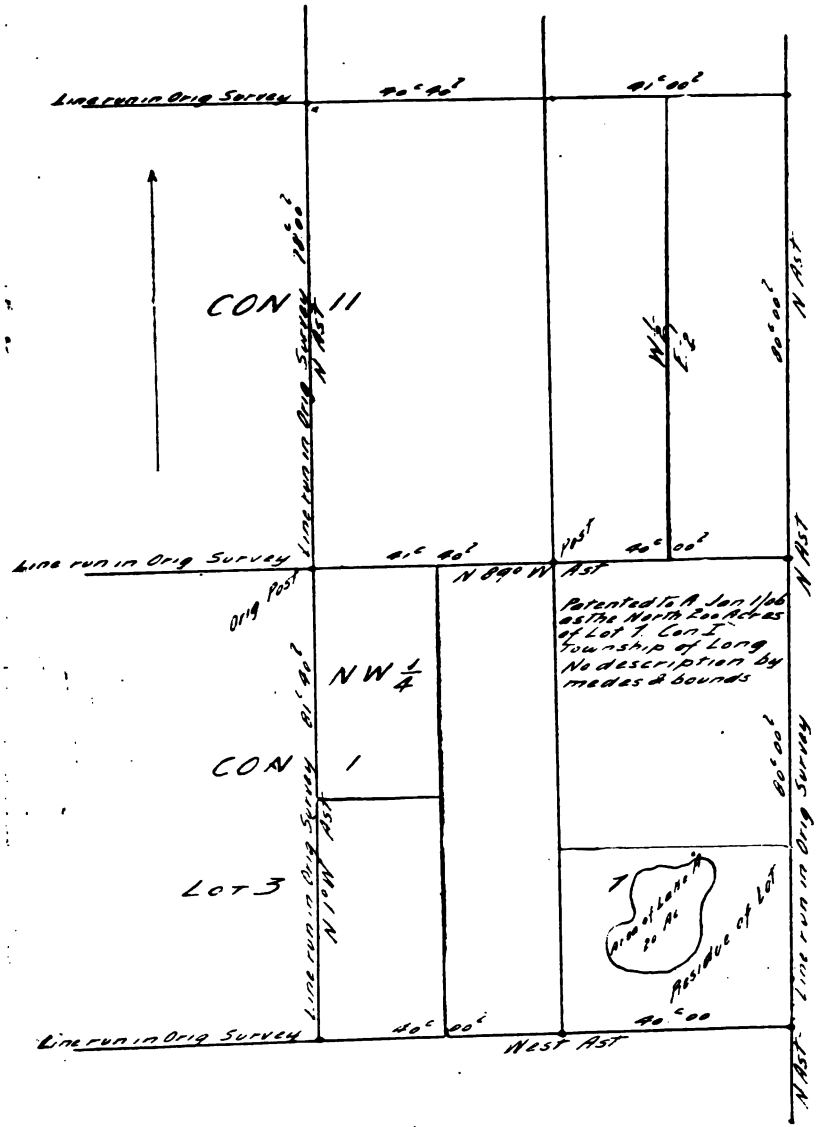
DESCRIPTIONS.

Attached is a diagram showing part of the township of Long subdivided into sections or blocks of 640 acres and lots of 320 acres or thereabouts. Assuming that the distances given on the diagram are theoretically correct as well as the bearings and lines are all run straight.

1. The north 200 acres lot 1, concession 1, was patented to A on the 1st January, 1906. The land in the patent is described as the north 200 acres of said lot. Make a description for the residue of the lot in which there is a lake containing 20 acres.

2. Describe by metes and bounds the northwest quarter of lot 2, concession 1. Give area and mark on diagram the length of outlines.

3. Mark on the diagram the division line between the east and west halves of lot 1, concession 2. Give the frontage and area of each half.



3a. If in lot 1, concession 2, there happened to be a lake containing 17 acres, what change, if any, would it make in the position of the division line between the east and west halves of the lot as given?

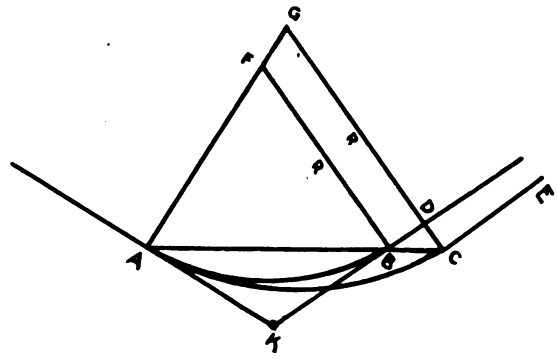
4. Make a description of part of lot 1, concession 1, township A, for right of way of the Canadian Pacific Railway 99 feet in width. The centre of the right of way intersects the east limit of lot 1, 18 chains south of the northeast angle and crosses the west limit of the lot 26 chains from place of beginning measured along centre line, the first course being south 45 degrees, west 21 chains, thence on a 2 degree curve 5 chains.

LAYING OUT CURVES—FINAL.

1. Define "Angle of Intersection," "Degree of Curve," "Length of Curve," "Deflection Angle," Sub-deflection Angle," "Simple Curve," "Compound Curve," "Reverse Curve"; and show the same by lettered diagram.

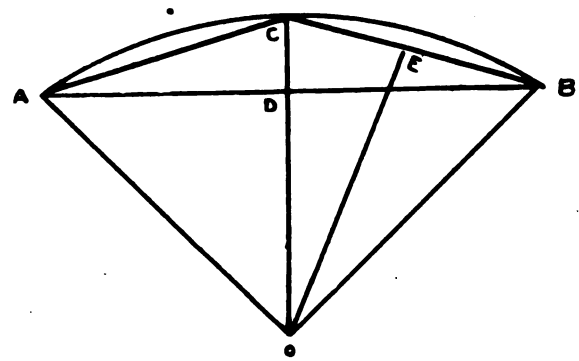
2. Show by lettered diagram and explain how to find the tangent at any station when laying out a curve by deflection angles. Given angle of intersection, 1= 21° and tangent, T=424.8, find the deflection angle, D.

3. Having run a curve AB, of radius R, terminating in a tangent BD, find the radius R^1 of curve AC that shall terminate in a given parallel tangent CE. (Given R, BC and BAK, find GC or R^1.)



4. When required to find the radius of a curve on a track already laid, we take any point C on the curve, measure two equal

chords AC and BC and the perpendicular CD. Give formula for finding the value of R; also the proof of same.



5. Show that the reversing point of a reverse curve between parallel tangents is in the line joining the tangent points.

FINAL PRACTICAL ASTRONOMY.

1. Define declination, right ascension, latitude, longitude, celestial latitude, celestial longitude, parallax, refraction, azimuth, vernal equinox and prime vertical.

2. Define mean, apparent, standard and sidereal time; and explain how, if given the mean time, you would proceed to find the other.

3. On Jan. 26, 1907, sidereal time, 1h. 35m. 25.5s., the apparent altitude of Polaris was found to be 44 17′ 30″. What was the latitude of the place of observation? Given Dec. of Star 88 48′ 54″ and R.A. 1h. 25m. 26s.

4. With the same data given in Question III., what was the azimuth of Polaris and the meridian reading? (The horizontal circle reading on the star during observation being 359 56′ 48″.)

5. On the same date and place as in Question III. find the sidereal time and the azimuth of Polaris when at its western elongation.

6. Lat. 43 6′ 18″ at 3 p.m. standard time Jan. 26, 1907, the apparent altitude of the sun's centre was found to be 18 42′ 24″; its declination at that time 18 50′ 48″. What was the azimuth of the sun's centre?

7. With the same data as given with Question VI., what was the apparent time of the observation?

8. In latitude 49 43′ 19″, given the length of a chord joining the meridian outlines of a township equal 720 chains;

(a) What would be the difference in longitude between the two outlines?

(b) What would be the change in the azimuth of a transit line in reference to the astronomic meridian nine miles from the starting point?

SURVEY ACT—FINAL.

(Oral Examination Required.)

Maximum 150; Minimum 90.

1. Describe what is known as the Sectional System of Survey; when was it introduced? and how are lines to be run therein?

2. Describe the manner in which double front concessions were laid out. How are lines to be run in these concessions? and when was the system introduced?

3. What do you understand by a single front concession? Mention a township laid out in this manner.

4. What is a proof line? Draw a diagram of a concession in which you would use a proof line.

5. How would you run lines in double front concession townships in which each alternate concession line only was run in the original survey?

6. How are lines to be run in those townships in the Rainy River District that were subdivided into sections in accordance with the Dominion Lands System of Survey?

7. How are lines to be run in those townships subdivided into blocks of 640 acres in the Nipissing District?

MINES AND OTHER ACTS.

1. What is a Mining Claim?

2. State how to be surveyed and described, (a) in unsurveyed land, (b) in a township surveyed. (1) into sections of 640 acres + or —. (2) in a township surveyed into lots of 320 acres + or —. (3) in a township surveyed into lots of 200 acres + or —. (4) in a township surveyed into lots of 100 acres + or —. (5) in a township where there are lots irregular in shape or size fronting on a lake, river or road.

3. What is a Special Mining Claim?

4. Before a Mining Claim in unsurveyed territory can be patented it has to be surveyed by an Ontario Land Surveyor. Define his duties therein.

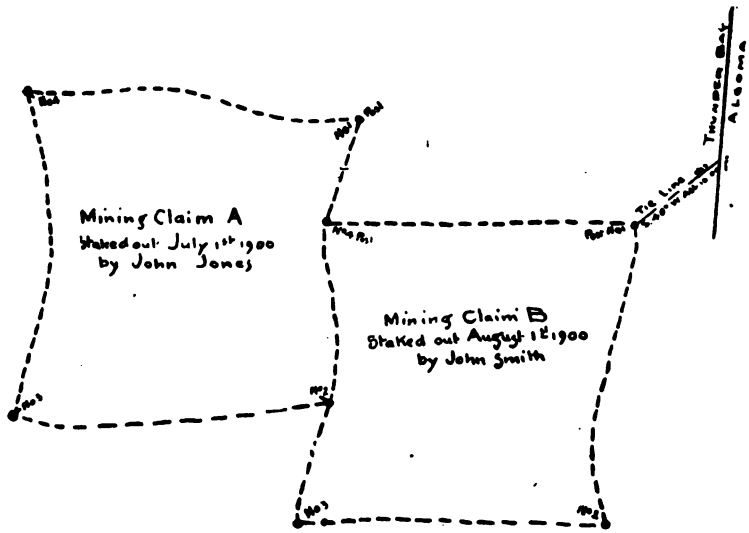


DIAGRAM OF MINING CLAIMS STAKED OUT IN THE MICHIPICOTON MINING DIVISION, DISTRICT OF THUNDER BAY.

5 If called on to survey Mining Claim B, as shown on diagram, how would you proceed to run the west boundary? The dotted lines represent the lines as actually cut out or blazed on the ground by the prospectors, and posts planted at each of the four angles. Assume bearings and directions for the outline of Claim B, mark on the diagram by full lines the boundaries as you would run them and write out a description by metes and bounds connecting by the line to O.L.S. T. B. Speight's 24th mile post on his boundary line between the Districts of Algoma and Thunder Bay.

Give the dimensions of a regular Mining Claim.

6. State the procedure of an engineer under the Ditches and Watercourses Act. Give an example.

7. Explain the following expressions and words in the Municipal Drainage Act:—"Initiating Municipality," "Maintenance," "Sufficient Outlet," "Owner," "Benefit," "Injuring Liability," "Outlet Liability." What is the first duty of an Engineer appointed under this Act?

LEVELLING.

Maximum 50; Minimum 35.

1. What is meant by each of the following: Height of a point; horizontal line; level line; vertical line; levelling; direct levelling; indirect levelling.

2. Describe the Y level and its adjustments.

3. Deduce the formula for correction for curvature.

   If the earth's diameter be 7,916 miles, what is the correction for 5 miles?

4. Describe: (a) How to run a grade line.
   (b) How to locate a level line.

5. Some readings recorded of a line of levels taken at stations 100 feet apart are as follows:—

   St. 65=4.95, B.M. No. 2, Elm Root 50 feet north of St. 65 =4.23; St. 66=4.60; 67=4.65; 68=5.50; 69 is T.P. F.S. to it 4.80=69.B.S. 4.65; 70=4.75; 71=5.00; 72=5.15; B.M. No. 3, Oak Root at 20 feet south of St. 72=3.95.

   (a) Record the above in Field Book of suitable form.

   (b) Reduce the levels to a common assumed datum and show the elevation of each point.

   (c) The cut at St. 65 being 5.00, what is the cut at each of the other stations, the grade being 1-10 of a foot per 100 feet?

FINAL PRINCIPLES OF EVIDENCE, ETC.

1. Explain the following words as applied to different kinds of evidence: Primary, secondary, circumstantial, hearsay, documentary, oral, traditional, interested, disinterested, direct, indirect and personal, and give cases where such evidence might be employed.

2. Explain the circumstances under which affidavits may be taken and why the courts do not readily receive them when taken by Ontario Land Surveyors.

3. How would you compel an unwilling witness to give evidence as to boundaries, produce, plans or documents?

4. Write affidavits proving the site of an old original post at the corner of a farm lot, but which has been lost or removed; to be three affidavits in which different kinds of evidence is to be used as traditional, etc.

5. What must be done with affidavits taken while making surveys?

6. At what date were Land Surveyors directed to take affidavits and keep regular field notes, etc.?

GEOLOGY AND MINERALOGY—FINAL.

1. State the mineral composition of granite and gneiss and how distinguished.

2. Give a simple method of determining the principal elements in compound minerals.

3. Explain a method of finding the specific gravity of a solid body, and find the specific gravity of a quartz crystal which weighs 293.7 grains in the air, and in water 180.1 grains.

4. State the differences between: travertine and marble, gypsum and calcite, galena and graphite, copper pyrites and iron pyrites, gold and copper pyrites.

5. State what the following minerals are ores of: Magnetite, sphalerite, cerussite, malachite, cinnabar, argentite, holite, calcite, apatite, gypsum, corundum, siderite, mispickel. What is the composition of the cobalt ores of New Ontario?

6. Explain, by diagram or otherwise, the following terms: Anticlinal, synclinal, unconformable, stratification, fault, outcrop, fossil, fold, sedimentary deposits, eruptive, and metamorphic rocks, structure, veins, country or wall rock, lode, a horse.

7. Give a description of the carboniferous age. What plants contributed mostly to the formation of coal? Name the localities in the Dominion of Canada in which coal measures are found.

8. Give a general description of the formations lying between Kingston and Niagara Falls. Show a section as to dip, and plan as to strike of these formations. Name the economic minerals in them.

9. State the theory of the origin of surface soil and the occurrence and extent of boulders in the same. Give the character and composition of the boulders in the vicinity of Toronto.

10. Give the general characteristics of the Laurentian and Huronian formations.

FINAL BOTANY.

1. Name, describe and give the functions of the several parts of a typical flower. State which are essential, and why.

2. Describe the chief functions of the leaf in plant life.

3. Describe the various methods adopted by plants for the dispersion of seeds, and for self-preservation.

4. Give an account of underground structures of flowering plants.

5. Describe the structure and mode of growth of exogenous and endogenous stems.

6. State the points of difference between,—

(a) A root and a stem.

(b) A rhizome and a tuber.

EXTRACTS FROM THE

BY-LAWS AND STATUTES

RELATING TO THE

ADMISSION AND EXAMINATION OF

Ontario Land Surveyors.

BY-LAWS.

EXAMINATIONS.

28. Candidates for admission to apprenticeship are to be examined as follows, in the subjects prescribed in Rev. Stat. Ont., c. 180, s. 22; and no candidate shall be admitted unless he obtains at least the minimum marks set opposite each subject, and at least a total of 550.

Examination of candidates for apprenticeship.

Subject.	Max. Marks.	Min. Marks.
1. Penmanship	50	30
2. (*a*) Orthography (including dictation)	50	40
(*b*) English Grammar	50	25
3. Arithmetic (Fractions, Decimals, Square Root)	100	60
4. Logarithms and Algebra (including Equations 1st Degree)	100	60
5. Euclid (Books 1, 2, 3 and 4)	100	60
6. Plane Trigonometry and Rules for Spherical	100	50
7. Mensuration of Superficies	50	30
8. Linear Drawing (use of ruling pen and construction of scales)	50	25
9. Canadian and General Geography	50	25
10. Canadian History	50	25

29. Candidates for admission to practice are to be examined as follows in the subjects prescribed in the Rev. Stat. Ont., c. 180, s. 25; and no candidate will be admitted unless he obtains at least the minimum marks set opposite each subject, and at least a total of 1,000.

Examination of candidates for admission to practise.

Subject.	Max. Marks.	Min. Marks.
1. Geometry, including the first 6 books of Euclid, excepting the last thirteen propositions of the fifth book	100	50
2. Algebra Simple and Quadratic Equations, Progressions and Exponents	100	50
3. Trigonometry Plane and Spherical	100	60
4. Mensuration of superficies and laying out and dividing land	150	75
5. Descriptions by metes and bounds	100	75
6. Use and Adjustment of Instruments for surveying and levelling	100	70
7. Laying out of Curves	50	30
8. Practical Astronomy, including finding of Time, Latitude, Longitude, Azimuth, Variation of Compass, and drawing Meridian Lines	150	90
9. Survey Act	150	90
10. Mines Act, Registry Act, Municipal Act (so far as they relate to surveys and drainage), Ditches and Watercourses Act	100	50
11. Levelling	50	35
12. Principles of Evidence and drawing up Affidavits	80	40
13. Taking of Field Notes and preparing of plans	100	60
14. Geology and Mineralogy (rudiments of)	75	40
15. Elementary Botany and the Forest Flora of Canada	50	25

30. If a candidate for admission to practice obtains at least the total of 1,000 marks, but fails to obtain the minimum marks in, at least, two of the subjects, such candidate may at a subsequent examination be examined only in the two subjects in which he has failed.

CHAPTER 180, R.S.O., 1897.

(An Act respecting Land Surveyors.)

* * * * * * * *

Meetings when and where to be held.

20. The said Board shall meet at the office of the Commissioner of Crown Lands, on the second Monday in the month of February, in every year, unless such Monday be a holiday (in which case they shall meet on the day next

thereafter not being a holiday, and may adjourn such meeting from time to time if they deem it necessary. R.S.O. 1887, c. 152, s. 6. 60 V. c. 27, s. 1.

* * * * * * * *

APPRENTICES.

Qualification for admission as an apprentice, and examination of applicant.

22. No person shall be admitted as an apprentice with any Ontario Land Surveyor unless he has previously passed an examination to the satisfaction of the Board of Examiners, in penmanship, orthography, English grammar, arithmetic, algebra (including square-root logarithms and quadratic equations), Euclid (first four books and deductions), plane trigonometry, spherical trigonometry as far as and including the solution of right-angled triangles, mensuration, practical geometry (including the use of ruling-pen and the construction of plane and comparative scales), Canadian and general geography and Canadian history, and has obtained a certificate of such examination and of his proficiency from the Board. 60 V. c. 27, s. 2.

Examination and Certificate Fees.

23. Every applicant shall before being so examined pay to the Secretary-Treasurer of the Association the fees chargeable as hereinafter provided for the said examination and certificate. R.S.O. 1887, c. 152, s. 8.

Notice to be given by Applicants.

24. Applicants for examination previous to apprenticeship shall give one month's notice to the Secretary of the Board of their intention to present themselves for examination, and shall pay to the said Secretary the fee for receiving and entering such notice. R.S.O. 1887, c. 152, s. 9.

QUALIFICATION FOR ADMISSION TO PRACTISE.

Qualification for Admission to practise.

25. Except as hereinafter provided no person shall be admitted to practise as a land surveyor in and for Ontario until he has attained the full age of 21 years, and has passed an examination before the Board of Examiners in the following subjects, viz., geometry, including the first six books of Euclid (with the exception of the last thirteen propositions of the fifth book), algebra, including progressions, plane and spherical trigonometry, mensuration of superficies, laying out and dividing of land, description by metes and bounds for deeds and other documents, the use and adjustment of surveying and levelling instruments, the laying out of curves, practical astronomy, including finding of time, latitude, longi-

tude, azimuth, variation of the compass, and drawing meridian lines, the Acts relating to the survey of lands in Ontario, *The Mines Act, The Registry Act*, so far as it refers to plans, the Municipal Acts so far as they relate to roads, surveys and drainage, *The Drainage Act, The Ditches and Watercourses Act*, the theory and practice of levelling, the principles of evidence, drawing of affidavits, taking of field notes and preparing plans, the rudiments of geology and mineralogy, elementary botany and the forest flora of Canada, and the sufficiency of his surveying instruments, and has served regularly and faithfully, for three successive years, except as in this section hereinafter provided, under an instrument in writing duly executed before two witnesses, as an apprentice to an Ontario Land Surveyor, duly admitted and practising therein as such, nor until he has received from the said land surveyor a certificate of his having so served during the said period, or proves to the satisfaction of the Board that he has so served. R.S.O. 1887, c. 152, s. 10. 60 V. c. 27, s. 3.

23. Any person serving as an apprentice as hereinbefore provided, may, with the permission of the Board of Examiners, attend the Ontario School of Practical Science, or any school, college or university, the course of study in which is in the opinion of the Board sufficiently similar to that in the Ontario School of Practical Science, for the purpose of taking any course of study which includes any subjects required for the final examination for admission to practise as a land surveyor, but the total period of such apprenticeship and of such course of study shall not exceed the period of four years from the date of the articles of apprenticeship as above mentioned, and not less than three years of the said period of four years shall be passed in the actual service of a practising Ontario Land Surveyor. 60 V. c. 27, s. 4.

27. In case a person who has attained the full age of 21 years and who has been practising as a land surveyor in any of His Majesty's dominions other than this Province, shall satisfy the Board of Examiners that the qualifications for practising required of such person in the said dominion were sufficiently similar to those required in this Province, and shall produce to the said Board his diplomas or certificates, such person shall not be required to serve as an apprentice, or shall only be required to serve during such period not exceeding three years as the said Board may consider requisite, after which such person shall on complying with the other requirements of this Act, have the right to undergo the

final examination, or such portions thereof as the said Board may consider necessary, and shall, if found qualified, practise as a Land Surveyor in Ontario. 60 V. c. 27, s. 6.

Graduates Royal Mil College ston, or tario Sc Practic Science McGill Montre have ce privile

28. The privilege of a shortened term of apprenticeship shall also be accorded to any graduate of the Royal Military College at Kingston, or of the Ontario School of Practical Science, in civil engineering or in mining engineering, or of the McGill College, Montreal, in civil engineering, and such person shall not be required to pass the preliminary examination hereinbefore required for admission to apprenticeship with a land surveyor, but shall be bound to serve under articles with a practising land surveyor, duly filed as required by section 32 of this Act, during twelve successive months of actual practice, after which, on complying with all the other requirements, he may undergo the examination prescribed by this Act. R.S.O. 1887, c. 152, s. 14. 60 V. c. 27, s. 7 (1).

Section 28 herein is amended by inserting after the second word "engineering," in the sixth line thereof the words, "or the School of Mining, Kingston, in civil engineering or in mining engineering." 63 V. c. 22, s. 1.

Attend certai during Appre ship.

29. Such person at any time during his apprenticeship may, with the permission of the Board of Examiners, attend the Ontario School of Practical Science, or any school, college, or university, the course of study in which is, in the opinion of the Board, sufficiently similar to that in the Ontario School of Practical Science, for the purpose of taking any course of study which includes any subjects required for the final examination for admission to practise as a land surveyor, but the total period of such apprenticeship, and of such course of study, shall not exceed the period of two years from the date of the articles of apprenticeship as above mentioned, and not less than twelve months of the said period of two years shall be passed in the actual service of a practising Ontario Land Surveyor. 60 V. c. 27, s. 7 (2).

If Su dies, servi be co with Surv

30. If a surveyor dies or leaves the Province, or is suspended or dismissed, or ceases to practise, his apprentice may complete his term of apprenticeship, under an instrument in writing as aforesaid, with any registered surveyor in actual practice. R.S.O. 1887, c. 152, s. 15. 60 V. c. 27, s. 8.

its tice- be d.

31. A surveyor may, by an instrument in writing, transfer an apprentice, with his own consent, to another registered surveyor in actual practice, with whom he may serve the remainder of the term of his apprenticeship. R.S.O. 1887, c. 152, s. 16. 60 V. c. 27, s. 9.

its Ser- filed.

32. No instrument in writing under which an applicant for admission to practise as a surveyor claims to have served with some practising surveyor for the required period shall avail to authorize the admission of an applicant, unless the instrument has been transmitted to the Secretary of the Board within two months next after the date thereof, nor unless the fee in respect thereof mentioned in section 39 of this Act was by the apprentice paid to the Secretary of the Board at the time of transmitting the indenture of articles; and the said Secretary shall acknowledge by post the receipt of all such instruments or copies thereof transmitted to him, and shall carefully keep the same filed in his office. R.S.O. 1887, c. 152, s. 16. 60 V. c. 27, s. 10.

ADMISSION OF CANDIDATES.

ex- n to by es for n.

33. Every person desiring to be examined by the Board as to his qualification to be admitted as a land surveyor, shall give notice thereof in writing to the Secretary of the Board, at least one month previous to the meeting thereof. R.S.O. 1887, c. 152, s. 18.

d to ertifi- ood etc.

34. Every person applying for admission to practise as a land surveyor shall produce to the Board satisfactory certificates as to character for probity and sobriety, and before a certificate is granted shall perform such practical operations in the presence of the Board, and shall answer such questions on oath (which oath any member of the Board may administer) with regard to the actual practice of such applicant in the field, and with regard to his surveying instruments, as the said Board may require. R.S.O. 1887, c. 152, s. 19.

* * * * * * * *

FEES.

fees.

39. The following fees shall be paid to the Secretary-Treasurer for the use of the Association:

1. By every person duly authorized to practise as a land surveyor under the provisions of this Act on applying for registration under this Act, the sum of $1.00.

2. By each member of this Association an annual membership fee of $4.00.

3. By each apprentice at the transmitting to the Secretary the indenture or articles of such apprenticeship, $10.00; 62 Vic. 2, c. 11, s. 18.

4. By each candidate for the preliminary examination on presenting himself for examination, $10.00.

5. By each candidate for examination, with his notice thereof, for receiving and entering such notice, $1.00.

6. By each applicant obtaining a certificate, as fee thereon, $2.00.

7. By each applicant receiving a certificate to practise, as an admission fee, $30.00.

8. By each apprentice with each transfer of articles as a fee for registering the same, $2.00.

9. By each applicant receiving a certificate to practise, being the fee for official notice in the *Ontario Gazette*, $1.00.

55 V. c. 34, s. 7; 69 V. c. 27, s. 26.

LIST OF MEMBERS

1907

The names of those members granted exemption by By-laws ratified by the Association are marked *.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Abrey, George Spencer, Toronto Junction	6th April, 1906
Allan, John Richard, Renfrew Grad. S.P.S.	6th Nov., 1894
Aylsworth, Charles Fraser, Jr., Madoc D.L.S.	8th Jan., 1886
Aylesworth, John Sidney, Selby P.O. Box 23 D.L.S.	9th Jan., 1871
Aylsworth, William Robert, Belleville, P.O. Box 2 D.L.S.	8th Nov., 1861
Baird, Alexander, Leamington C.E.	7th July, 1877
Barrow, Ernest George, Hamilton D.L.S., Mem. Can. Soc. C.E., City Engineer.	4th Oct., 1877
Bazett, Edward, Burk's Falls D.L.S.	8th July, 1881
Beatty, David, Parry Sound D.L.S.	12th July, 1869
Beatty, Herbert John, Eganville Grad. S.P.S.	8th Nov., 1893
Beatty, Walter, Delta D.L.S. M.P.P.	19th July, 1858
Bell, Andrew, Almonte B.A., Mem. Am. Soc. C.E., Mem. Can. Soc. C.E., Mem. Ont. A.A., D.L.S.C.E.	14th Oct., 1901
Bell, James Anthony, St. Thomas D.L.S., Co. Engineer, Elgin; City Engineer, St. Thomas.	11th Oct., 1875
Bigger, Charles Albert, Ottawa, 68 Daly ave. D.L.S., A.M. Can. Soc. C.E., B.C.S., Astronomer, Dept. Interior.	6th Jan., 1882
Bingham, Edwin Ralph, Winnipeg D.L.S.	17th Feb., 1906
Blake, Frank Lever, Toronto, Meteorological Office D.L.S.	13th April, 1875

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Blair, William John, New Liskeard.....13th Feb., 1904
Grad. S.P.S.

Bolton, Ellsworth Doan, Listowel.....7th Nov., 1899
B.A.Sc. (McGill).

Bolton, Lewis, Listowel.....9th July, 1864
D.L.S.

Booth, Charles Edward Stewart, Toronto,
39 Bloor st. e. .....6th April, 1882
D.L.S.

Boswell, Elias John, C.P.R. Construction Dept.
Offices, Winnipeg, 135 Carlton st.....7th Nov., 1896
Grad. S.P.S., D.L.S.

Bowman, Clemens Dersteine, West Montrose.10th July, 1879

Bowman, Herbert Joseph, Berlin.....7th Jan., 1887
D.L.S., Grad. S.P.S., Treasurer County Waterloo,. Assoc. Mem. Can. Soc. C. E.

Bowman, Edgar Peterson, West Montrose..17th April, 1907

Bray, Edgar, Oakville.....6th Oct., 1866
D.L.S.

Bray, Lennox Thompson, Amherstburg....17th Feb., 1902
D.L.S.

Bray, Harry Freeman, Oakville.....10th July, 1882
D.L.S.

Bray, Samuel, Ottawa, Dept. of
Indian Affairs.....6th Jan., 1877
D.L.S., C.E.

Brian, Michael Edward, Windsor.....17th Feb., 1906
B.A. Sc.,

Brown, David Benjamin, Cornwall.....6th April, 1889
D.L.S.

Brown, George Laing, Morrisburg.....19th Feb., 1898
Grad. S.P.S.

*Brown, John Smith (address not known)....8th July, 1852
D.L.S.

Browne, Harry John, Toronto, 157 Bay st....6th July, 1872
C.E.

Browne, William Albert, Toronto,
18 Toronto st. .....10th April, 1876

Burd, James Henry, Parry Sound.....2nd Oct., 1905
Grad. S.P.S.

Burgess, Edward LeRoy, Ottawa.....6th May, 1905

Burt, Frederick Percy, New York, N.Y. .....8th July, 1885
President "The American Architect," Times Bldg., New York.

Burwash, Nathaniel Alfred, Toronto.....6th May, 1905
D.L.S., Grad. S.P.S.

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Butler, Matthew Joseph, Deputy Minister of Railways and Canals, Ottawa.....11th Jan., 1878
C.E., M.I.C.E., Mem. Am. Soc. C.E., Mem. Can. Soc. C.E.

Byrne, Thomas, Sault Ste. Marie.....15th July, 1862
D.L.S.

Caddy, John St. Vincent, Ottawa, 559 King st..6th Oct., 1866
D.L.S.

Cameron, Alfred John, Peterborough.....9th April, 1889

Campbell, Archibald William, Toronto, Parliament Buildings .....10th April, 1885
C.E., Deputy Minister of Public Works.

Carre, Henry, 276 Albert st., Belleville, Box 203.....8th Nov., 1861
M.O. & Georgian Bay Canal, B.A. and C.E. (Trin. Coll., Dublin), D.L.S

*Carroll, Cyrus, Prince Albert, Sask. .....10th Jan., 1860
Mem. Can. Soc. C.E., D.L.S.

Casgrain, Joseph Philippe Baby, Montreal...5th Jan., 1887
D. L. S., P. L. S. (Que.) C. E., Assoc. Mem. Can. Soc. C. E., Chief Eng. M. & P. J. Ry., Senator.

Cavana, Allan George, Orillia.....8th July, 1876
D.L.S.

Chalmers, John, Engineer's Office, C.N.R., Winnipeg.....14th April, 1896
Grad. S.P.S.

Chipman, Willis, Toronto, 103 Bay st. .....4th Oct., 1881
D.L.S., B.A.Sc. (McGill), Mem. Am. Soc. C.E., Mem. Can. Soc. C.E.

Christie, Uriah Wesley, Orangeville. .....Feb., 1906

Clarke, Fred. Fieldhouse, Winchester, Ont.31st March, 1905
Grad. S.P.S.

Clarke, L.O., London, 291 Simcoe st. .....14th Feb., 1903

Code, Abraham Silas, Alvinston.....14th April, 1896

Code, Samuel Barber, Smith's Falls.....1st May, 1905

Code, Thomas George, Alvinston.....17th April, 1907

Code, Richard Stanley, Alvinston.....17th April, 1907

Cotton, Arthur Frederick, North Bay.....11th July, 1874

Cozens, Joseph, Sault Ste. Marie.....7th July, 1875
D.L.S.

Crerar, Samuel Rutherford, Toronto, School of Science.....1906
D.L.S., B.A.Sc., Toronto.

Dalton, John Joseph Weston, Ont.....1897
D.T.S.

*Davidson, Alexander, Arkona.....11th Oct., 1858
D.L.S.

Davis, Allan Ross, 230 Portage Ave., Winnipeg, Man. .....8th Jan., 1886
B.A. Sc. (McGill).

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Davis, John, Alton.....5th April, 1878

Davis, William Mahlon, Berlin.....11th April, 1885
Grad. R.M. Coll. (Kingston), Town Engineer.

Deacon, Thomas Russ, Winnipeg.....12th Nov., 1892
Grad. S.P.S.

Deans, William James, Brandon, Man....11th July, 1884
D.L.S.

DeMorest, Richard Watson, Sudbury.....9th April, 1889
M.E.

Dickson, James, Fenelon Falls.....6th April, 1867
D.L.S.

Dixon, Howard, Can. Nor. Ry., Winnipeg....14th Feb., 1903
Grad. S.P.S.

Dobbie, Thomas William, Tillsonburg.....11th July, 1856
D.L.S.

Dobie, James Samuel, Regina.....21st Feb., 1898
B.A.Sc. (Toronto Univ.), D.L.S., Director of Surveys, Sask.

*Doupe, Joseph, Winnipeg, Man.,
169 Edmonton st. .....13th Jan., 1863
C.E. (McGill), D.L.S., P.L.S. (Man.), P.L.S. (B.C.).

Dunn, Thomas Hamilton, Winchester. .....14th May, 1906
Grad. S.P.S.

Empey, John Morgan, Ottawa.....16th Feb., 1907
D.L.S.

Esten, Henry Lionel, Toronto, 157 Bay st....7th Jan., 1887

Evans, John Dunlop, Trenton.....8th July, 1864
D.L.S., Mem. Can. Soc. C.E., Chief Eng. Cent. Ont. Ry.

Fair, John, Brantford.....13th April, 1875

Fairbairn, Richard Purdom, Toronto,
452 Markham st. .....7th Oct., 1876
Surveyor for Dept. of Pub. Works, Ontario.

Fairchild, Charles Court, Simcoe.....9th April, 1894
Grad. S.P.S., D.L.S.

Fairchild, William Howard, Simcoe.....17th Feb., 1900

Farncomb, Alfred Ernest, Red Deer, Alberta.9th April, 1895
D.L.S.

Farncomb, Frederick William, London,
213 Dundas st. .....6th Nov., 1889

FAWCETT, THOMAS, Niagara Falls.....6th Jan., 1881
President Association of O. L. Surveyors, Dom. Topographical Surveyor.

Fitton, Charles Edward, Orillia, Box 142..10th April, 1879
D.L.S.

Fitzgerald, James William, Peterborough...13th Feb., 1904

Flater, Frederick William, Petrolea.....9th April, 1888

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Ford, William Butterton, Wabana, Nfld.....21st. Feb., 1898

Francis, John James, Sarnia P.O.,
Box 304 .....16th Oct., 1861
D.L.S.

Fuce, Edward Oliver, Galt. .....17th Feb., 1906

Fullerton, Charles Herbert, New Liskeard....7th May, 1906
D.L.S., Grad. S.P.S.

Galbraith, William, Bracebridge.....4th April, 1883
D.L.S.

Gamble, Killaly, Toronto, 31 Sussex Court..6th April, 1888
D.L.S., P.L.S. (Man.), Sec. Assoc. O.L.S., Captain R.A. (Ret').

Gardiner, Edward, St. Catharines.....6th Jan., 1866
D.L.S.

Gaviller, Maurice, Collingwood, Box 164....6th Jan., 1866
C.E. (McGill), D.L.S.

*Gibson, James Alexander, Oshawa.....7th April, 1855
D.L.S.

Gibson, Peter Silas, Willowdale.....19th July, 1858
C.E.M.S. (Mich. Univ.), D.L.S., Mem. Can. Soc. C.E., Eng. Tp. of York.

Gibson, Wilbert Silas, Willowdale.....21st Feb., 1898

Gillon, Douglas John, Fort Frances.....9th Nov., 1895
Grad. R.I.E. Coll.

Graydon, Aquila Ormsby, City Engineer
London.....8th July, 1880

Green, Thomas Daniel, Dawson City, Yukon..7th Jan., 1885
D.L.S.

Griffin, Albert Dyke, B.A., Woodstock.....11th Nov., 1890

Halford, Abraham Joseph Bartholomew, Essex Centre..

Hanes, George Samuel, Windsor. .....6th May, 1905
Grad. S.P.S.

Hart, Milner, Toronto, 103 Bay st. .....11th July, 1863
D.L.S.

Heaman, John Andrew, G.T.R., Union
Station, Toronto.....16th Nov., 1896

Henry, Frederick, London, Albion Bldg....7th April, 1887

Hobson, Joseph, Montreal, G.T.R. Office.....3rd Oct., 1855
D.L.S., Chief Eng. Grand Trunk Railway System.

Holcroft, Herbert Spencer, Toronto,
182 Bloor st. w. .....17th Feb., 1902
D.L.S., B.A.Sc. (Toronto Univ.).

Holland, Wm. Hugh, Toronto .....1st May, 1907.

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Hopkins, Marshall Willard, Edmonton, Alta. 13th Nov., 1893
D.L.S., B.A. Sc. (McGill), Assoc. Mem. Can. Soc. C.E.

Hutcheon, James, Guelph ..... 10th Nov., 1891
Grad. S.P.S.

Irwin, James Moore, Rat Portage ..... 13th Jan., 1863
D.L.S.

Jackson, John Herbert, Niagara Falls ..... 16th Feb., 1901

James, Darrell Denman, Toronto,
227 George st. ..... 3rd Nov., 1891
D.L.S. B.A., B.A.Sc. (Toronto Univ.),

James, Silas, Toronto, 227 George st. ..... 19th July, 1858
D.L.S.

Johnston, Herbert, Berlin ..... 21st Feb., 1905
Grad. S.P.S.

Jones, Charles Albert, Petrolea ..... 8th April, 1881
D.L.S.

Jones, John Henry, Sarnia, Box 194 ..... 10th Oct., 1886
D.L.S.

Jones, Thomas Henry, Brantford ..... 10th Oct., 1878
B.A.Sc. (McGill), D.L.S., City Engineer.

*Keefer, Thomas Coltrin, Ottawa ..... 14th Aug., 1840
D.L.S., C.E.

Kennedy, James Henry, Penticton, B.C. .... 7th April, 1887
C.E. (Toronto Univ.)

Kirkpatrick, George Brownly, Toronto,
Dept. of Crown Lands ..... 13th April, 1863
D.L.S., Director of Surveys.

Laird, James Stewart, Essex ..... 6th April, 1867
D.L.S.

Laird, Robert, Sudbury. ..... 11th Nov., 1887
Grad. S.P.S.

Lawe, Henry, Ottawa. ..... 6th Oct., 1860

Lewis, John Bower, Ottawa, Brunswick
House ..... 4th Oct., 1883
D.L.S., P.L.S. (Quebec), C.E.

Lougheed, Aaron, Port Arthur ..... 12th Nov., 1888
D.L.S.

Low, Edward Hamilton, Sudbury. ..... 17th Feb., 1902
Grad. R.M.C. (Kingston).

*Low, Nathaniel Edward, Wiarton ..... 11th July, 1856
D.L.S.

Lumsden, Hugh David, Ottawa ..... 4th Jan., 1866
C.E., D.L.S., M.I.C.E., Mem. Can. Soc. C.E., Chief Eng. Trans. Cont. Ry.

MacKay, James John, Hamilton ..... 25th Feb., 1899

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD

MacKenzie, William, Sarnia.....11th April, 1896
Grad. R.M.C. (Kingston).

MacKenzie, William Lyon (not known)....7th April, 1887
C.E.

McAuslan, Herbert James, Heathcote.....19th Feb., 1906

McCaw, Robert Daniel, Welland.....16th Feb., 1907

McCubbin, George Albert, St. Thomas,
City Engineer's Office .....9th Nov., 1895
Assistant City Engineer.

McDonell, Augustine, Chatham,
4 and 5 Eberts Block.....11th July, 1863
D.L.S.

McDowall, Robert, Owen Sound.....11th Nov., 1890
Grad. S.P.S., Town Engineer.

McEvoy, Henry Robinson, St. Mary's.....10th July, 1875
D.L.S.

McFadden, Moses, Neepawa, Man. .....13th April, 1858
D.L.S., P.L.S. (Man.).

McFarlen, George Walter, Toronto, City Hall,
City Engineer's Office.....11th Nov. 1858
Grad. S.P.S.

McGrandle, Hugh, Huntsville.....5th Jan., 1883
D.L.S.

McKay, Owen, Windsor, P.O. Box 167.....7th Jan., 1887
Grad. S.P.S., Chief Eng. D. & L. E. Ry.

McKenna, John Joseph, Dublin.....9th July, 1860
D.L.S.

McLatchie, John, Nelson, B.C., P.O. Box 128...9th Jan., 1864
D.L.S., P.L.S. (Que., Man. and B.C.).

McLean, James Keachie, Ottawa, Dept.
Indian Affairs.....8th April, 1876
D.L.S.

McLean, William Arthur, Toronto,
Parliament Buildings.....21st Feb., 1898
Secretary of Roads.

McLennan, Murdoch John, Williamstown...13th Nov., 1893
B.A.Sc. (McGill), D.L.S.

McMullen, William Ernest, St. John, N.B.....11th Nov., 1892
Asst. Eng. C. P. Ry.

McNab, John Duncan (not known).....9th Oct., 1879

McNaughton, Alexander Lorne, Cornwall.....May, 1905

McNaughton, Finlay Donald, Cornwall.....25th Feb., 1899

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

McPherson, Archibald John, Brockville....10th April, 1897
B.A. (Toronto Univ.), D.L.S.

McPherson, Charles Wilfrid, Dawson, N.W.T.
Director of Surveys, Yukon.....21st Feb., 1899
D.L.S., Director of Surveys, Yukon.

McPhillips, George, Winnipeg, Man.....9th July, 1885
D.L.S., P.L.S. (Man.).

Manigaut, William Mazyck, Strathroy,
P.O. Box 300 .....5th July, 1876

Meadows, William Walter, Windsor.....21st Feb., 1898
D.L.S., Grad. S.P.S.

Miles, Charles Falconer, 265 Triangle st.,
Buffalo, N.Y. .....13th Jan., 1862
D.L.S.

Miller, Frederick Fraser, Napanee.....5th Jan., 1885
D.L.S.

Montgomery, Royal Harp, Prince Albert, Sask.6th May, 1905
D.L.S.

Moore, John MacKenzie, London,
Albion Building .....9th Oct., 1879

Moore, John Harrison, Smith's Falls.....11th Nov., 1889
Grad. S.P.S.

Morris, Alfred Edmund, Montreal, Que. ..10th April, 1879

Morris, James Lewis, Pembroke.....7th July, 1886
D.L.S., C.E. (Toronto Univ.).

Mountain, George Alphonse, Ottawa.....9th Jan., 1884
Mem. Can. Soc. C.E., D.L.S., P.L.S. (Que.), Engineer for Railway Commission.

Murdoch, William, Bowmanville .....10th Jan., 1860
D.L.S., C.E.

Murphy, Charles Joseph, Toronto,
157 Bay st. .....6th Oct., 1886

Nash, Thomas Webb, Kingston.....7th April, 1854
D.L.S.

Newman, John James, Windsor.....21st Feb., 1898

Newman, William, Windsor,
57 Sandwich st. w. .....12th Nov., 1892
Grad. S.P.S.

Niven, Alexander, Haliburton.....8th July, 1859
D.L.S.

Ogilvie, William, 27 Nepean st., Ottawa.....12th July, 1869
D.L.S.

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

O'Hara, Walter Francis, 236 Waverly St., Ottawa. . . . . .14th April, 1892
D.L.S.

Parsons, Johnston Lindsey Rowlett, Toronto.6th May, 1905
D.L.S., Grad. S.P.S.

Patten, Thaddeus James, Little Current. . . . . .5th Jan., 1883
D.L.S.

Pinhey, Charles Herbert, Ottawa, 110 Wellington st. . . . . .12th Nov., 1888
D.L.S., Grad. S.P.S., Assoc. Mem. Can. Soc. C.E.

Proudfoot, Hume Blake, Toronto, 130 Roxborough st. w. . . . . .6th Jan., 1882
B.A.Sc. (Toronto Univ.).

Rainboth, Edward Joseph, Ottawa. . . . . .11th Nov., 1887
D.L.S.

Rainboth, George Charles, Aylmer, P.Q. . . .11th July, 1868
D.L.S., P.L.S. (Que.).

Reinhardt, Carl, Box 303, Cobalt. . . . . .25th Feb., 1899
B.A.Sc., McGill.

Reynolds, Samuel Henry, Winnipeg. . . . . .17th July, 1880

Roberts, Vaughan Maurice, St. Catharines. .5th April, 1887
D.L.S.

Robertson, James, Glencoe . . . . . .11th July, 1885
Grad. S.P.S.

Roger, John, Mitchell . . . . . .10th Nov., 1888
Grad. S.P.S.

*Rombough, Wm. R., Toronto, 254 Borden st.14th Nov., 1848
D.L.S.

Rorke, Louis Valentine, Toronto, 405 Temple Building . . . . . .14th April, 1890
D.L.S.

Ross, George, Welland . . . . . .10th July, 1879
B.A.Sc. (McGill), D.L.S.

Routly, Herbert Thomas. . . . . .1st May, 1907

Russell, Alexander Lord, Port Arthur. . . . . .16th April, 1873
D.L.S., P.L.S. (Que.).

Rutherford, T. N. . . . . .18th May, 1906

*Scane, Thomas, Ridgetown . . . . . .7th Jan., 1865
D.L.S.

*Schofield, Milton C., Guelph, Ont. . . . . .28th Sept., 1843
D.L.S.

Schwitzer, John Edward, C.P.R. Ry. Co., Winnipeg, Man. . . . . .16th Nov., 1896
B.A.Sc. (McGill).

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Seager, Edmund, Rat Portage .....8th July, 1861
D.L.S.

Selby, Henry Walter, 125 Howland ave., Toronto.....8th Jan., 1876
D.L.S.

Sewell, Henry DeQuincy, Toronto, 34 Yonge st.....9th July, 1885
D.L.S., A.M.I.C.E.

Seymour, Horace Llewellyn, Ottawa.....16th Feb., 1907
D.L.S.

Shaw, John Henry, North Bay.....17th Feb., 1900
Grad. S.P.S.

Silvester, George Ernest, Sudbury.....12th Nov., 1892
Grad. S.P.S.

Sing, Josiah Gershom, Toronto, Room 71, Confederation Life Building .....9th Jan., 1879
D.L.S., C.E., Public Works Dept.

Smith, Angus, Stratford .....14th April, 1896
Grad. S.P.S., City Engineer.

Smith, George, Box 25, Lindsay.....7th April, 1881
Engineer for Co. Victoria and four Townships.

Smith, James Herbert, New Liskeard.....27th Dec., 1904

Smith, Charles Campbell, Ottawa.....16th Feb., 1907
D.L.S.

Smith, Walter, Lindsay.....16th Feb., 1907

Speight, Thomas Bailey, Toronto, 405 Temple Building .....6th Jan., 1882
D.L.S.

Squire, Richard Herbert, Brantford, 54 Market St. .....14th April, 1896
B.A.Sc. (Toronto Univ.).

Stacey, Albert George, Ottawa.....16th Feb., 1907
D.L.S.

Steele, David Layton, Meaford. .....May, 1905

Steele, Edward Charles, Sault Ste. Marie....9th April, 1889
Assoc. Mem. Can. Soc. C.E.

*Stewart, George Alexander.....8th July, 1852
D.L.S.

Stewart, John, (address not known).....11th Nov., 1887
D.L.S.

Stewart, Walter Edgar, Aylmer .....12th April, 1892

*Strange, Henry, Rockwood .....30th Nov., 1838
D.L.S., C.E.

Stull, William Walter, Sudbury .....17th Feb., 1900
B.A.Sc. (Toronto Univ.).

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Tench, William Eastwood, Niagara Falls.

Townsend, David Thomas, Woodstock. ....17th Feb., 1906
D.L.S., B.A.Sc., Toronto.

Traynor, Isaac, Dundalk .....16th April, 1873
D.L.S.

Turnbull, Thomas, Winnipeg, Man.,
C. N. R. Eng. Office.... .....6th July, 1878
D.L.S., C.E. (Toronto Univ.).

Tyrrell, James Williams, Hamilton,
42 James st. n. .....8th April, 1885
C.E. (Toronto Univ.), D.L.S., Co. Eng. for Wentworth.

*Unwin, Charles, Toronto, 126 Seaton st....12th April, 1852
D.L.S., City Surveyor.

Ure, Frederick John, Woodstock .....7th April, 1887
D.L.S.

Van Nostrand, Arthur J., Toronto,
405 Temple Building .....30th Oct., 1882
D.L.S.

Waddell, William Henry, Hamilton. .....May, 1905
D.L.S.

Wadsworth, Vernon Bayley, Toronto,
103 Bay st. .....9th April, 1864
D.L.S.

Walker, Alfred Paverly, Toronto, Room 508,
Union Station, C. P. Ry., Eng. Office.....6th Jan., 1882
D.L.S., Mem. Can. Soc. C.E.

Wallace, James Nevin, Calgary, Alta.....21st Feb., 1898
D.L.S., B.A., B.E. (Trin. Coll., Dublin).

Ward, Archeson Thomas,
Toronto, 405 Temple Building .....10th April, 1897

Warren, James, Walkerton, P.O. Box 190....7th Oct., 1864
D.L.S.

Watson, John McCormack, Orillia,
P.O. Box 224 .....13th April, 1892

Wells, Arthur Frederick, Sandwich. .....17th Feb., 1906

Wetherald, Thomas, Goderich,
P.O. Box 273 .....12th Jan., 1856
D.L.S., C.E.

Weekes, Abel Seneca, Glencoe .....12th April, 1890
D.L.S.

Weekes, Melville Bell, Brantford .....17th Feb., 1900
B.A.Sc. (Toronto Univ.), D.L.S.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
West, Robert Francis, Orangeville	7th April, 1881
Wheelock, Charles Richard, Orangeville Treasurer County of Dufferin.	7th Jan., 1886
Whitson, James Francis, Toronto, Dept. of Lands, Forests and Mines	9th Jan., 1886
Wicksteed, Henry King, Cobourg D.L.S., C.E.	7th Jan., 1886
Wiggins, Thos. Henry, Finch, Ont. Grad. S.P.S.	10th Nov. 1891
Wilde, John Absalom, Sault Ste. Marie	9th April, 18
Wilkie, Edward Thomson, Carleton Place D.L.S.	11th April, 1891
Wilkins, Fred. Wm., Norwood, Ont. D.T.S.	6th Jan., 1877
Williams, David, Port Arthur. D.L.S.	9th April, 1864
*Winter, Henry, Thornyhurst D.L.S., C.E.	11th July, 1853
*Wood, Henry O., Billings Bridge	10th Oct., 1855
*Yarnold, William Edward, Port Perry, P.O. Box 44 D.L.S.	7th April, 1854

REGISTERED AND WITHDRAWN.

The names of those who have become "Associates" under By-law No. 39 are marked *; and under By-law No. 45 are marked †.

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Anderson, John Drummond, Trail, B.C....13th April, 1892

Anderson, William Beaumont, Ottawa, 178 Cartier st. .....14th Feb., 1903
Grad. R.M.C., B.A.Sc. (McGill), M. Can. Soc. C.E., D.L.S.

Apsey, John Fletcher, Cumberland, Md.....6th Jan., 1886
Grad. S.P.S.

Aylsworth, Charles Fraser, Sr., Madoc.....2nd April, 1861
D.L.S.

Bowman, Arthur Meyer, Mahan, Beaver Co., Pa. .....11th Nov., 1887
Grad. S.P.S., Staff of U. S. Engineers.

Bowman, Franklin Meyer, Bellevue, Allegheny Co., Pa. .....11th April, 1892
Grad. S.P.S., Engineer Structural Iron Works.

Brady, James, Victoria, B.C., P.O. Box 815..15th July, 1862
M.E.

Burnet, Hugh, Victoria, B.C.....5th April, 1887
D.L.S., P.L.S. (B.C.).

Cambie, Henry John, Vancouver, B.C.....8th July, 1861
D.L.S., P.L.S. (B.C.).

Carbert, J. Alfred, Medicine Hat, Assa....7th April, 1876
Dist. Eng. and Surveyor.

Carpenter, Henry Stanley, Collingwood....25th Feb., 1899
D.L.S., B.A.Sc., Toronto.

*Charlesworth, Lionel Clare, Edmonton, Alta. .....14th April, 1896
Grad. S.P.S., Director of Surveys, Saskatchewan, D.L.S.

Coleman, Richard Herbert, Toronto, Can. Co. Offices, Imperial Bank Chambers .....6th Oct., 1877

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Drewry, William Stewart, Ottawa.
Dept. of the Interior .....5th April, 1883
D.L.S.

Dueker, William A., Winnipeg, Man.....6th April, 1882
D.L.S., P.L.S. (Man.), Swamp Lands Comm'r.

Edwards, George, Thurso, P.Q.....6th Jan., 1866
D.L.S.

*Ellis, Henry Disney, Kuching, Sarawak,
Borneo .....7th April, 1877
D.L.S., Commissioner of Pub. Works and Surveys.

Galbraith, John, Toronto,
School of Prac. Science.....13th April, 1875
M.A., D.L.S., Prof. Engineering S.P.S.

Gibbons, James, Ottawa, Dept. of the Int..15th April, 1890
Grad. S.P.S., Dominion Topographical Surveyor.

Gibson, George, St. Catharines.....10th April, 1860
D.L.S.

Gibson, Harold Holmes, Jackson, Kentucky..8th Sept., 1891

*Harris, John Walter, Winnipeg, Man.....6th Oct., 1866
P.L.S. (Man.), D.L.S., Assessment Com.

*Harvey, Thos. Alex.,
239 Vernon ave., Long Island, N. Y. City.13th Nov., 1893

Henderson, Eder Eli, Henderson P.O., Maine.7th April, 1887
Grad. S.P.S.

Hermon, Ernest Bolton, Vancouver, B.C.....7th Oct., 1885
P.L.S. (B.C.), D.L.S.

Innes, William Livingstone, Simcoe.....14th April, 1892
C.E. (Toronto Univ.).

Jephson, Richard Jermy, Winnipeg, Man..7th April, 1877
P.L.S. (B.C.), D.L.S.

Johnson, Sydney Munnings, Greenwood, B.C.9th Nov., 1895

Johnston, Robert Thornton, The Riviera,
142 st. and 7th ave., N. Y. City.....9th April, 1899

*Kippax, Hargreaves, Huron, South Dakota.7th July, 1877
C.E. (Toronto Univ.), Assistant to Surveyor-General.

Kirk, John Albert, Revelstoke, B.C.....6th July, 1877
D.L.S., P.L.S. (B.C.).

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Klotz, Otto, 437 Albert st., Ottawa.....6th Jan., 1867
Dom. Top. Surveyor, C.E. (Mich. Univ.), LL.D.

Lane, Andrew, Sparrow's Point, Md.....4th April, 1895
Grad. S.P.S., Draftsman Maryland Steel Co.

Lendrum, Robert Watt, Strathcona, Alta....8th Jan., 1874
D.L.S.

Livingstone, Thomas Chisholm,
(address not known) .....10th Jan., 1859
D.L.S.

MacLeod, Henry Augustus F., Ottawa,
340 Cooper st. .....11th Oct., 1856
D.L.S., C.E.

MacPherson, Duncan, Montreal .....9th Jan., 1884
Grad. R.M.C., M.I.C.E., Mem. Can. Soc. C.E., Div. Eng. East Div. C.P.R., D.L.S.

McCulloch, Andrew, Lake Nelson, B.C.....
Grad. S.P.S., Assoc. Mem. Can. Soc. C.E., City Engineer.

McLennan, Roderick, Toronto .....20th Jan., 1846

Magrath, Charles Alexander, Lethbridge, Alta. 1st Nov., 1881
B.A.Sc. (McGill), D.L.S., P.L.S. (B.C.).

Marshall, James, Blyth. .....6th Oct., 1866
D.L.S.

Moore, Thos. Alexander, London South....12th Nov., 1892

Munro, John Vicar, New York, N.Y.,
359 West 31st st. .....9th April, 1895

†Paterson, James Allison. .....5th April, 1878
C.E., Mem. Can. Soc. C.E.

Pearce, William, Calgary, Alta.....12th Oct., 1872
D.L.S., P.L.S. (B.C.), Asst. B.C. Land Commissioner for C.P.R.

Peterson, Peter Alexander, Montreal, P.Q...16th July, 1863
D.L.S., C.E. (Toronto Univ.)

Ponton, Archibald William, Macleod, Alta..9th April, 1880

Purvis, Frank, Mesa City, Arizona.....7th April, 1875

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Reid, John Lestock, Prince Albert, Sask....8th April, 1870
D.L.S.

Reiffenstein, James Henry, Ottawa,
Dept. of the Interior.....16th April, 1873
D.L.S.

Reilly, William Robinson, London,
361 Simcoe st. .....7th April, 1881
D.L.S., P.L.S. (Man.).

Ritchie, Nelson Thomas, Kipiegan, Man.....9th Nov., 1888
P.L.S. (Man.)

Robinson, Franklin Joseph, Regina.....21st Feb., 1898
Grad. S.P.S., D.L.S., Dep. Min. Pub. Works.

Rogers, Richard Birdsall, Peterborough.....9th Jan., 1879
B.A.Sc. (McGill), D.L.S.

*Ross, Joseph Edmund, New Westminster,
B.C. .....11th Nov., 1890
D.L.S., P.L.S. (B.C.).

Sanderson, Daniel Leavens, Coral, Mich.....4th Oct., 1882

Saunders, Bryce Johnston, Edmonton, Alta—7th Jan., 1885
B.A.Sc. (McGill), D.L.S.

Shaw, Charles Aeneas, Greenwood, B.C.....6th Oct., 1877
P.L.S. (B.C.).

Sherman, Ruyter Stinson, Mission City, B.C.12th April, 1890
P.L.S. (B.C.).

Smith, Henry, Toronto, Dept. of Lands,
Forests and Mines.....8th Nov., 1861
D.L.S., Mem. Can. Soc. C.E.

Stewart, Elihu, Ottawa, Dept. of Interior..8th April, 1872
D.L.S., Chief Inspector of Forestry.

*Stewart, Louis Beaufort, Toronto,
School of Prac. Science .....6th April, 1882
Dom. Top. Surveyor, Professor of Surveying.

*Taylor, William Verner, Montreal,
Sovereign Bank Buildings.....7th Nov., 1896
Grad. S.P.S.

Tracey, Thomas Henry, Vancouver, B.C....8th April, 1870
C.E., P.L.S. (B.C.), D.L.S.

NAME AND P.O. ADDRESS. DATE OF ADMISSION BY BOARD.

Vicars, John Richard Odlum, Kamloops, B.C..5th Jan., 1887
P.L.S. (B.C.), D.L.S.

Wallace, Charles Hugh, 36 Dame st., Dublin, Ireland .....9th Nov., 1889
C.E. (Trin. Coll., Dublin), Dom. Top. Surveyor.

Wheeler, Arthur Oliver, Calgary, Alta.....8th July, 1881
P.L.S. (B.C.), D.L.S., Topographer. Dept. of Interior.

SUMMARY.

Active members subject to dues.....	228
Active members exempted from dues.....	17
Withdrawn from practice (including 9 Associates)....	67
Dead....	60
Total number enrolled since incorporation.....	372

DECEASED MEMBERS.

NAME.	LATE RESIDENCE.	DATE OF P.L.S. CERTIFICATE.	DATE OF O.L.S. REGISTRATION.	DIED.
Abrey, George Brockitt	Toronto Junction	10th January, 1860	1892	25th June, 1906.
Barrett, Russell H	Pembroke		14th February, 1903	30th January, 1905.
Bigger, Samuel Howell	Ottawa		30th January, 1904	7th July, 1906.
Bolger, Francis	Lindsay	10th October, 1863	1892	3rd November, 1895.
Bolger, Thomas Oliver	Kingston	6th July, 1865	1892	—— ——
Bolton, Jesse Nunn	Toronto	6th April, 1867		—— ——, 1901.
Bowman, Leander Meyer	Toronto	14th April, 1892	1892	20th September, 1895.
Brown, David Rose	Cornwall	10th October, 1850	1892	14th May, 1900.
Burke, William Robert	Ingersoll	5th April, 1878	1892	10th June, 1897.
Caddy, Cyprian F	Campbellford	10th July, 1860	1892	—— August, 1905.
Caddy, Edward C	Cobourg	18th December, 1846	1892	26th September, 1897.
Cheeseman, Thos	Mitchell	11th July, 1856	1892	—— ——, 1905.
Coad, Richard	Glencoe	8th October, 1879	1882	17th May, 1897.
Creswicke, Henry	Barrie	8th July, 1864	1892	22nd January, 1898.
Cromwell, Joseph M. O	Perth	1st October, 1846	1892	19th October, 1897.
Davidson, Walter Stanley	Sarnia	9th April, 1884	1882	December, 1900.
Deane, Michael	Windsor	16th May, 1848	19th December, 1882	3rd April, 1897.
DeGurse, Joseph	Windsor	5th April, 1883	1892	22nd March, 1898.
Filmore, Stanley H	St. Thomas		17th February, 1902	16th June, 1904.
FitzGerald, James William	Peterborough	13th July, 1857	1892	——, 1901.
Foster, Frederick Lucas	Toronto	9th April, 1863	1892	27th July, 1899.
Fowlie, Albert	Orillia	13th January, 1863	1892	—— April, 1898.
Fraser, Charles	Wallaceburg	5th August, 1847		—— ——, 1905.
Gibbs, Thomas Fraser	Adolphustown	31st May, 1841	1892	17th April, 1893.
Gilliland, Thomas Brown	Eugenia	11th July, 1868	25th January, 1890	14th December, 1898.
Gilmour, Robert	Toronto	11th April, 1856	1892	29th December, 1903.
Hanning, Clement George	Preston	19th July, 1858	1892	7th May, 1905.
Haskins, William	Hamilton	5th July, 1855	1892	5th July, 1896.

Hermon, Royal Wilkinson	Rednersville	13th July, 1857	1892	9th February, 1907.
Hewson, Thomas Ringwood	Hamilton	6th July, 1877	1892	21st October, 1898.
Howitt, Alfred	Gourock	12th January, 1856	1892	6th May, 1896.
Kains, Tom	Victoria	11th July, 1873		——— ———, 1901.
Kirk, Joseph Green	Stratford	16th February, 1843	1892	22nd January, 1906.
Lynch-Staunton, Francis H.	Hamilton	11th October, 1856	1892	11th June, 1899.
Macdougall, Allan Hay	Port Arthur	4th April, 1859	1892	—— February, 1906.
MacMillan, James Alexander	Calgary	6th January, 1877	24th December, 1894	——— ———, 1898.
MacNab, John Chisholm	Hamilton	8th January, 1880	1894	16th October, 1897
McAree, John	Toronto	6th April, 1867	1894	12th December, 1903.
McCallum, James	Fort Francis	30th March, 1849	1894	—— July, 1906.
McGeorge, Wm. Graham	Chatham	8th January, 1866	1892	1st July, 1906.
Malcolm, Sherman Morgan	Blenheim	11th October, 1858	1894	13th January, 1899.
Ogilvie, John Henry	Rat Portage	8th April, 1876	24th April, 1894	21st September, 1898.
Pedder, James Robert	Doon	10th November, 1891	23rd December, 1892	17th January, 1897.
Pope, Robert Tyndal	Ireland	13th April, 1875		——— ———, 1905.
Proudfoot, Hart William	Saskatoon, Assa.	6th May, 1905		31st March, 1906.
Reid, James Hales	Bowmanville	6th October, 1866	1892	22nd December, 1899.
Robinson, William	London	—— May, 1846	1892	11th October, 1894.
Rubidge, Tom S.	Cornwall	9th February, 1849	1892	——— June, 1904.
Sankey, Villiers	Toronto		1892	10th July, 1905.
Simpson, George Albert	Winnipeg	7th October, 1864	1892	8th January, 1905.
Spry, W.				——— ———, 1906.
Strathern, John	B.C.	5th October, 1876	1892	——— ———, 1897.
Tiernan, Joseph Martin	Tilbury Centre	7th January, 1886	1892	—— December, 1900.
Thomson, Augustus Clifford	Chicago	14th January, 1861	1892	—— December, 1896.
Van Buskirk, William Fraser	Stratford	7th April, 1883	1892	30th January, 1905.
Wagner, William	Ossowo	13th April, 1858		——— ———, 1901.
Walsh, Thomas William	Simcoe	25th April, 1842	1892	14th March, 1895.
Wheelock, Charles John	Orangeville	——— ———, 1856	1892	4th July, 1897.
Willson, Alfred				20th May, 1906.

Acknowledgment.

THE Association cheerfully acknowledges the receipt of advertisements from the persons and firms whose names appear below, and desires the careful consideration of these advertisements by all who read the proceedings.

The firms are reliable and deserving of patronage.

List of Advertisements.